

11 777h

112.4.1/3

THE
Writing-master
and
ACCOUNTANT'S ASSISTANT

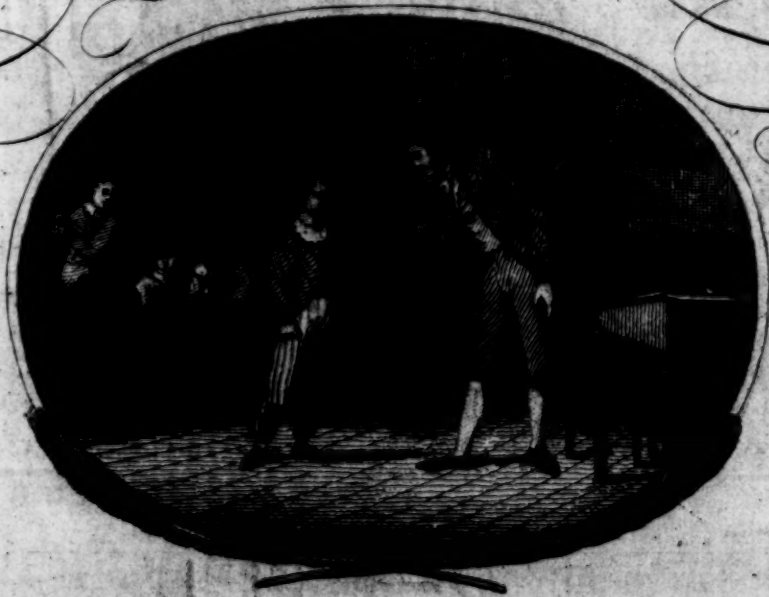
Containing an extensive System

of
Practical Arithmetic

With a valuable Set of ENGRAVINGS of Business Writing &c.

DESIGNED FOR THE USE OF ACADEMIES AND BOARDING SCHOOLS

Written by
S. Buchanan
GREENOCK.



Engraved by
Kirkwood & Son.
EDINBURGH.

GLASGOW:
Printed for the Author, by
R. CHAPMAN.

SOLD BY G. G. & J. ROBINSON, CADDELL & DAVIS, VERNOR & HOOD, AND J. JOHNSON, LONDON;
W. CREECH, AND BELL & BRADFUTE, EDINBURGH;
J. & A. DUNCAN, DUNLOP & WILSON, BRASH & REID, D. NIVEN,
A. CAMERON, AND J. MURDOCH, GLASGOW.

1798.

10



P R E F A C E.

PUBLICATIONS which are in any degree calculated to improve the taste,—to simplify the teaching, or to facilitate the study of any useful branch of education, will readily find a patron, in every unprejudiced person of genius and reflection; particularly in those, whose interest and happiness are immediately connected with the tuition of the rising generation: but whether or not the following plan may be found to answer in any respect *these* ends for which it is *principally* intended, remains to be known after examination and fair trial. In endeavouring, however, to gain such important points to the business of Teaching, and at the same time, to render it as cheap and useful as possible, the Author has ventured to follow the dictates of his own experience and reflection, rather than any particular Writer or opinion whatever, by which he finds that he has been led considerably out of the common tract in the formation of the plan; and, though he offers no new discovery essential to the science of Computation, or considers the public in any great want of ingenious books on the subject; yet he presumes the work, (independent of those parts of it which ~~are~~ new,) will have an equal claim with any other to the favour of the public, on account of the great variety of common Arithmetic which it contains.

THE Copperplate part is a thing perfectly original, and indeed, it was chiefly from an opinion that such a thing might be useful that induced the Author to turn his thoughts to a publication of the kind. Its advantages, he thinks, must be very obvious, as by it the teacher will be safer to begin his pupils early to cyphering than he could possibly do without it—for it serves the purposes, in a great measure, of copying from written specimens, merely to improve the hand, while a great deal of time is saved, and his taste for fine writing, figures, and arrangement, insensibly assimilated to the examples before him, by which also he acquires habits of neatness and order in keeping his books, that must prove highly beneficial, particularly to him who is designed to take an active part in the management of that kind of business where these qualifications are indispensibly requisite.

THE referring letters interspersed through the questions, by which the states of many of them are made out in most of the rules, are given as initiatory hints to the scholar, and as helps to the master in explaining the principles of the art, as he leads him onward. They are meant to steer a middle course between the insipid prolixity of illustrations, and the common brevity and abstruseness of general rules; being neither

so obscure as to allow the learner to be unnecessarily perplexed, nor yet so very plain as to supersede the exertion of his own abilities: rendering them at once entertaining and instructive, as well as simple and satisfactory.

THE criteria may, by some, be considered as too difficult and laborious to solve for most of scholars; especially when they are obliged to travel through a great number of rules in the course of the operation, before they arrive at the answer: but, if they are taught to work them from the beginning, the transition from easy to difficult becomes imperceptible, and while it enables the teacher to judge of his pupil's knowledge of those rules he has gone through, and determines him as to his fitness to proceed to that which follows next in course, it gradually inures him to the labour of calculation, and teaches him to figure with facility, exactness, and dispatch: acquisitions, which are generally of greater consequence in the preliminary stages of the science, and even in common life, than very subtle questions, or the most ingenious and conclusive demonstrations.

THE unusual form into which the book is put up, may be objected to as awkward; but it's being the best plan for showing the writing part, and being about the ordinary size of books used by scholars for copying their accounts into, it becomes a fitter pattern, in different respects, for them to imitate than any other, and sufficient reasons for printing it in the way it is.

THE price also, by others, may be considered as high, for a common school book; but to any person who knows the expence of engraving—who has a just conception of the value of a scholar's time at school—the peculiar faculty of children for imitating either good or bad specimens—the strength of early habits, &c. &c. will at once perceive the propriety of putting the best subjects into their hands, and (provided the work pleases in other respects) will not hesitate to pronounce the difference betwixt it and the cheapest Arithmetical text books that are used, an inadequate consideration to its comparative advantages. Notwithstanding of these arguments, however, the author is fully aware of the natural disposition of the illiberal part of the public to spurn at any untried scheme, unless it carry along with it such a glare of merit, as to render it immediately interesting.—But without being over anxious about its present reception, with a becoming confidence in the wisdom of the judicious, he resigns it to their inspection, from whom it must receive it's future character.

WRITINGMASTER AND ACCOUNTANT'S ASSISTANT.

DEFINITIONS.

- 1 **A** UNIT, or unity, signifies one universally, and denotes the beginning of numbers.
- 2 An integer signifies any whole number, as a year, a month, a ton, a yard, &c.
- 3 A mixed number is a whole number, with some part of a unit annexed, which part is called a fraction.
- 4 A prime number is that which cannot be divided by any number but unity.
- 5 A composite or compound number is that which can be divided by another number.
- 6 A common measure is that which will divide two or more numbers, and leave no remainder.
- 7 A number which measures another number is called an even or aliquot part of that number, and the number so measured is called a multiple of that even part.
- 8 An even number is that which can be halved or divided into two equal parts.
- 9 An odd number is that which cannot be halved, or which differs from an even number by unity.

AXIOMS.

An Axiom is a self-evident truth, which needs no demonstration.

- 1 The sum, difference, or product of any two whole numbers is a whole number.
- 2 The sum of any number of even numbers is an even number.
- 3 The sum of any even number of odd numbers is an even number.
- 4 The sum of any odd number of odd numbers is an odd number.
- 5 If an even number be taken from an even number the remainder will be even.
- 6 If an odd number be taken from an odd number the remainder will be even.
- 7 If an even number be taken from an odd one, or an odd one from an even one, the remainder will be odd.
- 8 If an odd number be multiplied by an odd number the product will be odd.
- 9 If an even number be multiplied by any number, either even or odd, the product will be even.
- 10 If an odd number measures an odd number, the quotient will be odd.
- 11 If an odd or even number, measures an even one, the quotient will be even.
- 12 If one number measures another, it will also measure any multiple of it.

- 13 If an odd or even number measures an even one, it will also measure the half of it.
- 14 If a number measures the whole of any number, and a part of it, it will also measure the remainder.
- 15 If a number measures two other numbers it will also measure their sum and difference.
- 16 The sum or difference of two numbers will measure the difference of their squares.
- 17 The sum of two numbers will measure the sum of their cubes; and the difference of two numbers will measure the difference of their cubes.
- 18 If a square measures a square, or a cube a cube, the root will also measure the root.

EXPLANATION OF CHARACTERS

which are often used to shorten and illustrate the procedure in Arithmetical operations.

- = Equality, denotes that the number on both sides are equal, as 20 cwt. = 1 ton, 12 pence = 1 shilling, &c.
- + Plus, signifies more, and denotes that the numbers on each side of it are to be added, as $5 + 6 = 11$, reads, five added to six is equal to eleven.
- Minus, signifies less or wanting, and denotes that the number after it is to be subtracted from that before it, as $8 + 10 - 6 = 12$, read, eight added to ten, wanting six, is equal to twelve.
- × Signifies multiplied into, and denotes that the numbers between which it stands, are to be multiplied together, as $8 + 10 - 6 \times 4 = 48$, read, eight added to ten, wanting six, which multiplied into four, is equal to forty-eight.
- ÷ Signifies divided by, and denotes that the number before it is to be divided by the one after it, as $8 + 10 - 6 \times 4 \div 6 = 8$, read, eight added to ten, wanting six, multiplied by four, and divided by six, is equal to eight.
- : :: Signs in Proportion. See introduction to that rule.
- √ Square root, denotes that the root of the number before it is to be extracted, as $16 \sqrt{} = 4$, read, the square root of sixteen is equal to four.
- ³√ Cube root, denotes that the number before it is to be extracted, as $27 \sqrt[3]{} = 3$, read, the cube root of twenty-seven is equal to three.

Also, in the course of the following system—*r* stands for remainder—*s* for sum—*p* for product—and *q* for quotient; besides other abbreviating letters used; but as they are peculiar to certain rules, they are defined at the beginning of these rules respectively.

A R I T H M E T I C

DEPENDS upon these five rules, viz. Notation, Addition, Subtraction, Multiplication and Division, which give rise to many others which branch out from them.

Numerical Alphabet, 1 2 3 4 5 6 7 8 9 0*.

N O T A T I O N

Teaches the method of writing numbers according to their value.

EXAMPLES to be written in Figures.

Five hundred and nineteen—Two thousand three hundred and eighty-six—One million five hundred thousand—Four trillions—Nine thousand trillions—Seven hundred billions—Sixty-seven thousand millions, seven thousand and seven.

EXAMPLES to be written in Words.

125—890506—3950000—7589321006
3300551200676320—5834823123021210
25302683943745684300.

A D D I T I O N +

Teaches how to bring several numbers into one total sum.

EXAMPLES.

123456789	3876754329	346832903
123456789	2534389682	217983482
987654321	5428165425	126834738
987654321	7385928732	452052342

2222222220

4th. 26328432+3876540+2905640330
5th. 742365421+48397641+4632483934
6th. 5876432148+3248392+5849348743
7th. 7943248368+28432498+987943842934
+924387234+60483265+7958

To prove Addition add downward, or cut off the top line, add those left, which sum added to the top line which was cut off, will be equal to the total sum; or, cast the nines out of all the lines, and set down the excesses in a column, out of

which cast the nines, then will the excess be equal to the excess arising after casting the nines out of the total sum.

S U B T R A C T I O N —

Teaches how to take a lesser from a greater number, and consists of a minuend or upper term, a subtrahend or under term, and remainder.

EXAMPLES.

123456789	482001221	1232164289
98765432	289601062	384925421

24938948582976
18529873694829

798432849835983
539648492847327

49784297352848
38978432897479

948321094838792
789438207024086

784638493285692
486953792934834

1298484389283297
973879297348209

To prove Subtraction add the remainder and under term, the sum will be equal to the upper term.

CRITERION.

1234567890+5369542676542+36286+542121862653
+3212634263418+3806589654321865+54265416267
65+11111111=—6354567650110=3814787162816420

M U L T I P L I C A T I O N ×

Supplies the place of many additions, and consists of a multiplicand, a multiplier and product.—Is proved by the cross, or division, or by changing the multiplicand for the multiplier, and the multiplier for the multiplicand, and proceeding as before.

EXAMPLES.

CASE I.

6891234567899×2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12.

* The Indians are the original inventors of these characters, though generally ascribed to the Arabs. The Romans made use of their own letters to represent numbers, as I=1, II=2, III=3, IIII or IV=4, V=5, VI=6, VII=7, VIII=8, IX=9, X=10, L=50, C=100, D=500, M=1000, MM=2000, ICC=5000, VICC=6000, &c.—Note, A letter of less value placed before one of greater, lessens; but put after, augments the value.

Arithmetic

Is the Art of computing by Numbers

Numeration

Table

5 th Period	4 th Period.	3 ^d Period.	2 nd Period.	1 st Period.
Quadrillions	Trillions	Billions	Millions	Hund. thous. Tens of thous. Thousands Hundreds Tens Units
CXT CX	CXT CX	CXT CX	CXT CX	
163, 598.	369, 873.	820, 753.	246, 782.	587, 021

Examples.

to be written in figures according to the Table
Nineteen. 19. One hundred and seventy. 170.

1875

1890

[illegible]

[The page contains faint, illegible handwriting, likely bleed-through from the reverse side.]

Addition

Teaches how to bring two or more numbers into a total sum.

Examples

1st

123456789
123456789
123456789
123456789
123456789

2nd

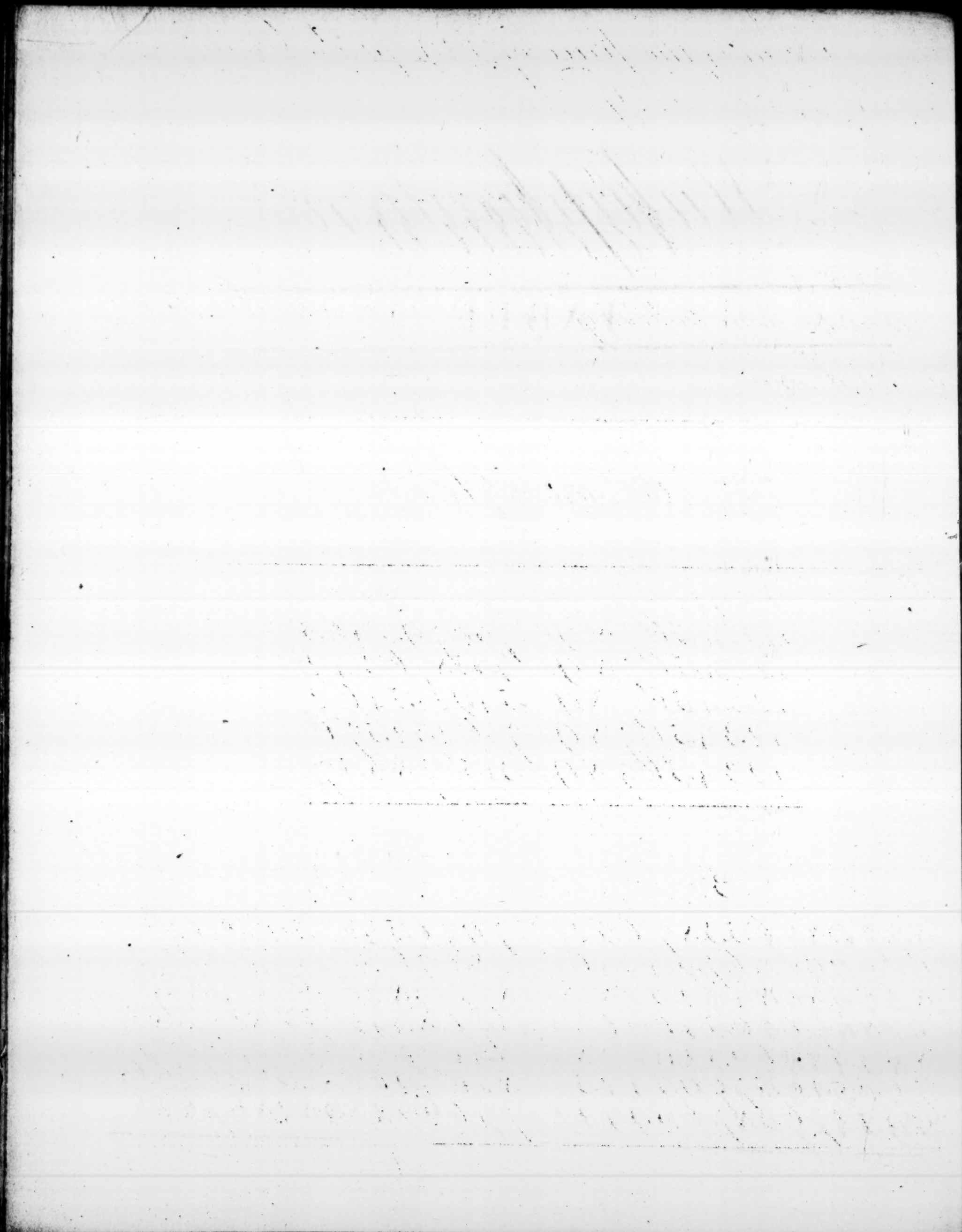
786795463
435876342
549215462
716232576
315678357

3rd

87638765387632
62626346754386
87658684325283
12867686546261
83438262526128
76589657695425
95427638765942

4th

797654675976325
286762634762867
876382656767638
476834676686768
346762676242327
816426165626386
746228382867686



Multiplication

TABLE

2	2 is 4 3 6 4 8 5 10 6 12 7 14 8 16 9 18 10 20 11 22 12 24	4	7 is 28 8 32 9 36 10 40 11 44 12 48	7	7 49 8 56 9 63 10 70 11 77 12 84
		5	5 is 25 6 30 7 35 8 40 9 45 10 50 11 55 12 60	8	8 64 9 72 10 80 11 88 12 96
3	3 is 9 4 12 5 15 6 18 7 21 8 24 9 27 10 30 11 33 12 36			9	9 81 10 90 11 99 12 108
4	4 is 16 5 20 6 24	6	6 is 36 7 42 8 48 9 54 10 60 11 66 12 72	10	10 100 11 110 12 120
				11	11 121 12 132
				12	12 144

1844

*Received of the Treasurer of the
County of ... the sum of ...
for ...*

Wm. B. Smith

1844

<i>1000.00</i>
<i>2000.00</i>
<i>3000.00</i>
<i>4000.00</i>
<i>5000.00</i>
<i>6000.00</i>
<i>7000.00</i>
<i>8000.00</i>
<i>9000.00</i>
<i>10000.00</i>

Division

Division teaches to find how often one number is contained in another and consists of a divisor, dividend, quotient and remainder.

Examples

$$762576 / 567005759.04 / 74354, \text{ Answer}$$

$$\begin{array}{r} 5338032 \\ \hline \end{array}$$

$$\begin{array}{r} 3320255 \\ \hline \end{array}$$

$$\begin{array}{r} 3050304 \\ \hline \end{array}$$

$$\begin{array}{r} 2699519 \\ \hline \end{array}$$

$$\begin{array}{r} 2287728 \\ \hline \end{array}$$

$$\begin{array}{r} 4117910 \\ \hline \end{array}$$

$$\begin{array}{r} 3812880 \\ \hline \end{array}$$

$$\begin{array}{r} 3050304 \\ \hline \end{array}$$

$$\begin{array}{r} 3050304 \\ \hline \end{array}$$

.....

[Faint handwritten signature]

This image shows a blank page from a document. It features several faint, horizontal lines across its surface, which appear to be scanning artifacts or very light pencil marks. There are also numerous small, dark specks and noise distributed throughout the page, likely due to the quality of the scan or the condition of the original paper. No legible text or distinct figures are present.

Note, To prove Multiplication by the cross, first cast the nines out of the multiplicand, and set the excess on the right hand, then cast them out of the multiplier, and place the excess on the left, multiply these two excesses into one another, out of the product cast the nines, and place the excess on the top, then cast the nines out of the product, and the excess will agree with the top line.

CASE 2.

Set down the first figure of each product below its respective multiplicand, then add.

81234567899 $\times$ 26, 28, 381, 469, 9687, 54387956, 987658, 5987695432, 8764267642, 389996.

CASE 3.

Cut off the right hand cyphers of both factors before you begin to multiply, and affix them to the product.

$$\begin{array}{r} 665 \mid 000 \\ 25 \mid 000 \\ \hline 3325 \\ 1330 \\ \hline 16625000000 \end{array} \quad \begin{array}{c} 2 \\ 7 \times 8 \\ 2 \end{array} \quad \begin{array}{l} 9767000 \times 600,5430000 \\ \times 3600,500 \times 300,360130 \\ 01500 \times 56001300000. \end{array}$$

CASE 4.

Take the component parts of the following multipliers, and multiply them into the products of each other, this will facilitate the process very much, particularly in Compound Multiplication.

67638765 $\times$ 14, 18, 36, 132, 144, 3865, 7862, 32186.

CASE 5.

Multiply by the integers of the multiplier, and take the aliquot parts of the fractions.

$$\begin{array}{llll} 786 \times 7\frac{1}{2} & 95432 \times 3\frac{1}{2} & 962 \times 7\frac{1}{2} & 695 \times 6\frac{1}{2} \\ 963 \times 37\frac{1}{2} & & & \end{array}$$

Operation of question 4th.

$$\begin{array}{r|l} \frac{4}{8} & \frac{1}{2} \\ \hline 695 \\ 6\frac{1}{2} \\ \hline 4170 \\ 347\frac{4}{8} \\ 173\frac{6}{8} \\ 86\frac{7}{8} \\ \hline 4778\frac{1}{8} \end{array} \quad \begin{array}{l} 6 \times 8 + 7 \times 695 \div 55 = 4778\frac{1}{8} \\ \text{or } \left\{ \begin{array}{l} \text{after multiplying by the integers} \\ \text{multiply by the numerator of} \\ \text{the fraction, and divide by the} \\ \text{denominator.} \end{array} \right. \end{array}$$

CASE 6.

Add the next right hand figure of the multiplicand every time after you have added the carriage, and add the last figure of the product to the left hand figure of the multiplicand.

1343865632 $\times$ 16, 17, 18, 19, 13, 14, 15.

CRITERION.

$$18654869 + 8696964 + 85438695 + 85423516 + 854286367654 + 768 + 320 = 363 = r \times 76001\frac{1}{2} = 15157489039063\frac{1}{2}$$

DIVISION $\div$

Teaches how often one number is contained in another, and consists of a divisor, a dividend, a quotient and remainder. Is proved by the cross or multiplication.

EXAMPLES.

The following short rule may be got by heart.

"First ask how oft? in quot the answer make,

"Then multiply, subtract, and down a figure take."

CASE 1.

767543876987628 $\div$ 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 18, 24, 78, 89, 97, 1587, 9766, 39438, 76569, 68765, 965696, 3265876, 396543, 879542, 196764358.

Note, To prove division by the cross, cast the nines out of the divisor and quotient, place the excesses on the right and left sides of a cross; cast the nines out of the product of these two figures, and add the excess to the remainder, if any; out of that sum cast also the nines, and place the excess at the top of the cross; lastly, cast the nines out of the dividend, and place the excess at the bottom: Then will the top and bottom figures agree, if the work is right.

CASE 2.

Divide by the component figures of the divisor—To find the true remainder, multiply the last partial remainder into the preceding partial divisor, to which add the remainder of that divisor.

76865432968 $\div$ 12, 18, 24, 72, 108, 132, 144.

CASE 3.

Cut off as many figures in the dividend, as there are cyphers in the divisor.—Take down the figures which were cut off from the dividend, and affix them to the remainder for the whole remainder.

86954386563 $\div$ 1000, 100000, 5600000, 369000, 8695000, 5696560000.

CASE 4.

Multiply the denominator of the fraction into the integer, to which add the numerator for a divisor, and multiply the dividend by the denominator for a new dividend.

7685438694 $\div$ 7 $\frac{1}{2}$, 4 $\frac{1}{2}$, 8 $\frac{1}{2}$, 9 $\frac{1}{2}$, 8 $\frac{1}{2}$.

CRITERION.

$$7696 + 3006586 + 1965438691 + 9643686 + 386965 = 3667696 = r \times 3800100\frac{1}{2} = p \div 87600\frac{1}{2} = 85667557902\frac{1}{2}$$

Note, When the scholar is very expert, he may be taught to work this rule by setting down only the remainders, and performing the rest mentally; but contractions of every kind, as well as this, are only useful, when they are simple and convenient.

EXERCISES IN ADDITION.

A has paid B at one time L.796, at another L.3796, at another L.5760, and owes him still, L.978. What is A's debt? *Answer*, L.11330.

A owes to B L.7379, to C L.4578, to D L.53676, to E L.67980, to F L.678, to G L.193437, to H L.479680. Required A's debt? *Answer*, L.807408.

A Farmer laid out on oxen L.345, on horses L.279, on sheep L.196, on cows L.345, on timber L.98, on iron L.54, on labouring utensils L.204, on household expences L.58. Required his total disbursement? *Answer*, L.1579.

John owes Robert L.7359, Andrew L.4578, Thomas L.53696, Archibald L.67890, William L.678, Peter L.193437, Alexander L.479680. Required John's debt? *Answer*, L.807318.

EXERCISES IN SUBTRACTION.

A Merchant went to market, and carried with him L.8965 (a), he bought linen to the amount of L.1600 (b), broad cloths L.1786 (c), duffles L.190 (d), flannels L.196 (e), corduroys L.26 (f), his expences came to L.5 (g). I demand how much money he carried home? *Answer*, $b+c+d+e+f+g-a=L.5162$.

How long is it since the year 1688 (a), the year of the Revolution, this being 1797? (b). $b-a=109$ years.

A Gentleman just now living in London, is aged 106 (a) years; in what year was he born, this being anno 1797? (b). $b-a=1691$ years.

Six bags of money, containing as follows, the first bag L.25 (a), the second bag L.80 (b), the third bag L.37 (c), the fourth bag L.100 (d), the fifth bag L.150 (e), the sixth bag L.180 (f), which was to be paid to different persons, but one of the bags being lost, there were but L.472 (g) paid. I demand which bag was lost? $g-a+b+c+d+e+f=L.100$.

EXERCISES IN MULTIPLICATION,

To be proved by Division.

How many letters in a book consisting of (a) 5 volumes,

each volume (b) 165 leaves, each page (c) 40 letters broad and 86 deep? $a \times b \times c \times d = 5676000$ letters.

There is a field (a) 168 poles in length, and (b) 96 do. in breadth, how many poles in the field? $a \times b = 16128$ poles.

A person dying left a chest, containing (a) 2 tills, in every till (b) 4 drawers, in every drawer (c) 5 purses, in every purse (d) 50 guineas, how many were left in all? $a \times b \times c \times d = 2000$ guineas.

How many strokes does the hammer of a clock strike in 3 years? $1+2+3+4+5+6+7+8+9+10+11+12 \times 2 \times 365 \times 3 = 170820$ strokes.

How many feet in a road (a) 23 miles long and (b) 18 feet broad? $a \times 1760 \times 3 \times b = 2185920$ feet.

How many feet in a floor (a) 39 feet long and (b) 19 feet broad? $a \times b = 741$ feet.

How many herrings in a sloop's cargo of (a) 70 lasts†, each barrel containing (b) 850 herrings? $a \times 12 \times b = 714000$ herrings.

How many threads of woof in a web of (a) 120 yards, reckoning (b) 60 threads to an inch? $a \times 3 \times 12 \times b = 259200$ threads.

What is the sum, and what the difference betwixt six dozen of dozens, and half a dozen of dozens? Sum 936, Difference 792.

What is the sum, and what the difference betwixt the cube of 36, and the square of 98*? Sum 56260, Difference 37052.

EXERCISES in MULTIPLICATION & DIVISION,

where the one is intended to prove the other.

Divide L.10,000 among 2 men and 3 women, and give each man double of a woman.

$$2 \times 2 + 3 = 7) 10000 (1428\frac{4}{7} \text{ a woman's share.}$$

In L.6754 how many farthings? Note, 960 f.=L.1. *Answer*, 6483840 farthings.

In 17653840 grains, how many pounds Troy? Note, 5760 gr.=1 lib.

In 974 lbs. Avoirdupoise, how many drams? Note, 256 dr.=1 lib.

In 587398563 scruples, how many pounds? Apoth.— Note, 288 sc.=1 lb.

In 5753438976 inches, how many miles? Note, 63360 in.=1 mile.

In 1954 chalders, how many lippies? Scotch Corn Mea. Note, 1024 lip.=1 ch.

In 1692876549832 minutes, how many years? Note, 525600 m.=1 year.

* Any number multiplied into itself, produces a square, and any number multiplied three times into itself, produces a cube.
† A last consists of 12 barrels.

Addition of Money

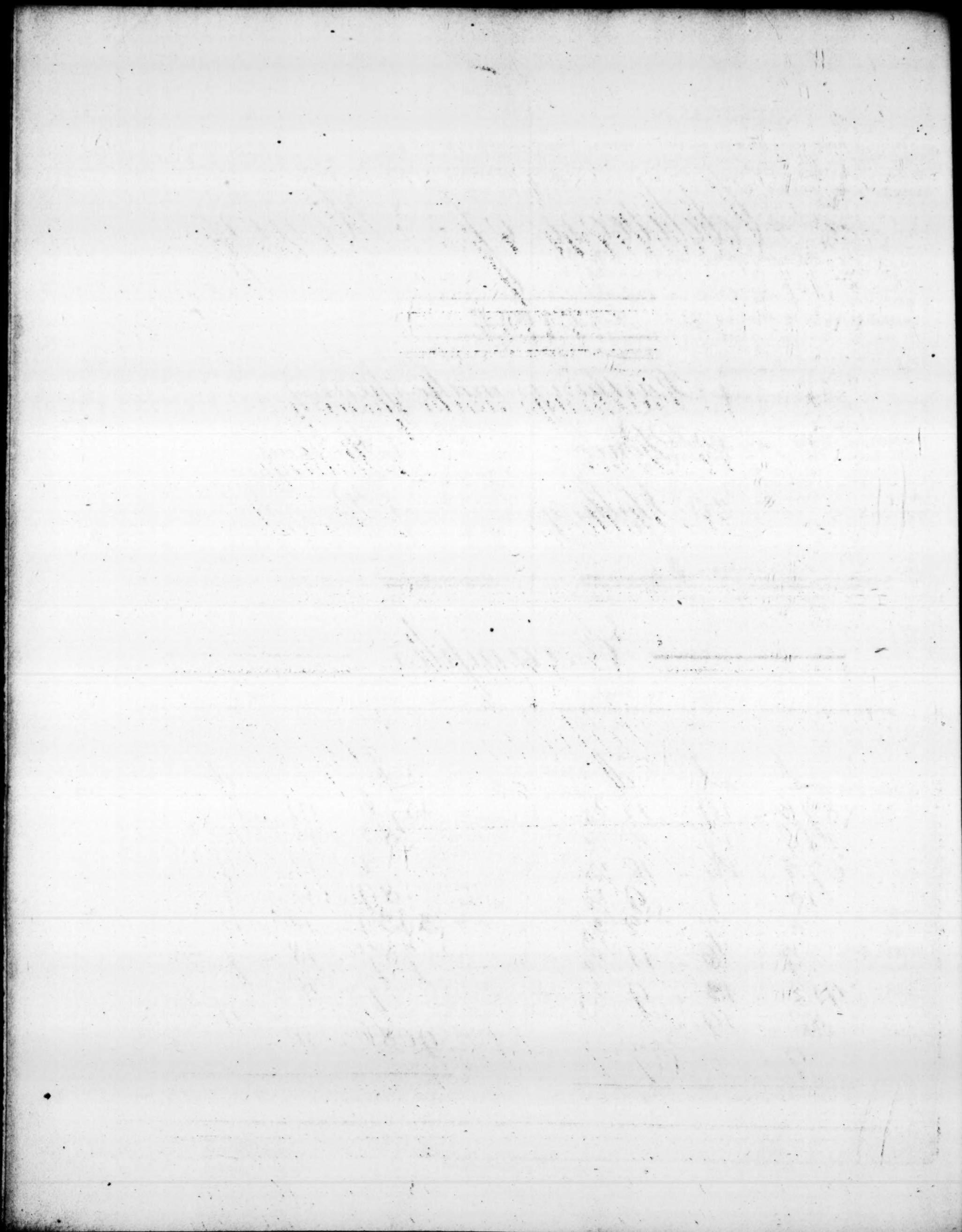
TABLE

4 Farthings make a penny
 12 Pence 1 Shilling
 20 Shillings 1 Pound

Examples

£	s	d
876	10	11 $\frac{3}{4}$
128	12	10 $\frac{1}{2}$
875	16	10 $\frac{1}{4}$
18	1	9 $\frac{1}{2}$
8	7	2 $\frac{3}{4}$
9	6	11 $\frac{1}{2}$
912	13	9 $\frac{3}{4}$
80	19	
9	1	7

£	s	d
1876	19	11 $\frac{3}{4}$
83	11	10 $\frac{1}{2}$
2	12	9 $\frac{1}{4}$
89	18	1 $\frac{3}{4}$
3434	16	11 $\frac{1}{4}$
787	18	7 $\frac{3}{4}$
7	10	
		11 $\frac{3}{4}$
9086	10	$\frac{1}{4}$



OF ENGLISH MONEY.

Note, $\frac{1}{4}$ stands for a farthing, $\frac{1}{2}$ for a halfpenny, $\frac{3}{4}$ for three farthings, and 21s. a guinea, 5s. a crown, 25s. a Jacobus, 27s. a moidore, 36s. a joannes, 10s. an angel, 13s. 4d. a mark, 6s. 8d. a noble*.

EXAMPLES IN ADDITION†.

L.	S.	D.	L.	S.	D.	L.	S.	D.
20	12		20	12				
5	19	11	17	19	11	57905	19	11 $\frac{1}{4}$
3	14	9	189	10	11	5953	19	10 $\frac{1}{4}$
8	17	6	10	19	1	215	19	11 $\frac{1}{4}$
5	14	3	118	12	10	58	14	10 $\frac{1}{4}$
7	12	4	59	15	11	9	11	9 $\frac{1}{4}$
9	18	5	96	11	9	15083	19	11 $\frac{1}{4}$

AVOIRDUPOISE WEIGHT.

16 drams, or dr. make 1 ounce, 16 oz. a pound, 28 lib. a quarter, 4 qrs. a hundred weight, 20 cwt. a ton.

Ct.	qrs.	lib.	Lib.	oz.	dr.	T.	ct.	qrs.	lib.	oz.
5	3	27	689	15	15	5	19	3	27	15
6	2	21	583	12	14	8	18	2	26	14
3	1	25	35	13	12	7	17	1	25	15
5	2	18	838	10	10	9	16	3	24	12
17	1	16	163	10	11	16	19	3	26	13
18	2	16	183	13	14	18	11	1	19	12
19	1	15	99	10	6	17	12	3	16	13

TROY WEIGHT.

24 grains, or gr. make 1 pennyweight, 20 dwts. an ounce, 12 oz. a pound.

Lib.	oz.	dwt.	gr.	Lib.	oz.	dwt.	gr.
16	11	19	23	1683	11	19	23
18	10	18	22	800	0	0	19
18	10	17	21	1	6	15	16
16	5	16	23	65	7	18	15
18	6	14	21	76	0	0	16
14	5	13	14	695	7	16	18
18	3	14	11	565	11	10	13

APOTHECARIES WEIGHT.

20 grains, or gr. make 1 scruple, 3 sc. a dram, 8 dr. an ounce, 12 oz. a pound.

Lib.	oz.	dr.	scr.	gr.	Lib.	oz.	dr.	scr.	gr.
168	11	7	2	19	100	11	7	2	19
1987	10	3	1	12	56	10	5	1	17
6898	5	1	2	15	183	10	4	2	16
9865	5	2	1	0	10	11	0	0	17
5	0	0	0	10	79	10	0	1	0
7	0	2	1	0	5	0	1	0	10
65	7	0	2	0	6	10	1	0	16

CLOTH MEASURE.

2 $\frac{1}{2}$ inches, or in. make 1 nail, 4 nails a quarter, 4 qrs. a yard, 3 qrs. an ell Flemish, 5 qrs. an ell English, 6 qrs. an ell French, 37 $\frac{1}{2}$ in. an ell Scotch.

Yd.	qr.	n.	E.F.	qr.	n.	E.E.	qr.	n.
8	3	3	55	2	3	99	4	3
7	2	2	67	1	1	568	1	2
9	1	1	97	1	2	896	2	1
8	3	0	999	1	2	65	2	3
89	0	2	68	1	1	23	0	0
65	2	1	600	2	3	1100	0	0
63	1	3	295	1	2	222	0	0

LONG, OR LINEAL MEASURE.

3 barley corns, or b. c. make 1 inch, 12 in. a foot, 3 feet a yard, 5 $\frac{1}{2}$ yards a pole, perch or rod, 40 poles a furlong, 8 furlongs, or 1760 yards a mile, 3 miles a league. This respects length only.

Le.	m.	f.	p.	Le.	m.	f.	p.	yds.	ft.	in.	bc.
169	2	7	39	96	2	7	39	4 $\frac{1}{2}$	2	11	2
28	1	3	21	21	1	3	5	3	1	10	2
167	1	2	18	676	2	2	6	4 $\frac{1}{2}$	1	11	1
816	2	1	16	376	1	0	0	0	0	10	0
96	1	2	17	5	0	0	0	1	1	0	0
56	2	1	16	368	2	7	17	4	2	10	1
69	0	6	17	56	1	3	27	2*	1	11	1

* Add this column like farthings.

SQUARE MEASURE.

144 inches make 1 foot, 9 feet a yard.

Yds.	f.	in.	Yds.	f.	in.
69	8	143	765	8	143
87	7	112	56	7	128
965	2	1	165	3	128
323	1	5	815	6	125
365	1	7	342	7	125
282	6	119	982	7	142
526	7	142	15	3	121

SCOTCH LAND MEASURE.

9 $\frac{1}{2}$ square feet make 1 square ell, 36 square ells a square fall, 4 falls a rood, 4 roods an acre, 94 acres a mile.—The Scotch chain is 74 feet.

ENGLISH LAND MEASURE.

144 square inches make 1 square foot, 9 square feet a yard, 30 $\frac{1}{2}$ square yards a pole or perch, 40 square poles a square rood, 4 square roods a square acre.—This includes length and breadth.—The English chain 66 feet 10 chains long and 1 broad make an acre.

* In 1797 orders were given for a new coinage of penny, twopenny, three and sixpenny, and seven shilling pieces.

† The scholar can be at no loss in this rule to know what to carry, as each denomination at the top line, is just 1 less than what is to be carried.

<i>A.</i>	<i>r.</i>	<i>p.</i>	<i>A.</i>	<i>r.</i>	<i>p.</i>
16	3	39	198	3	39
17	2	16	686	2	26
18	1	12	767	1	12
15	1	13	676	2	13
19	3	26	342	1	16
167	2	16	765	2	17
178	1	13	626	1	18
176	2	16	743	2	12

SOLID MEASURE.

1728 inches make 1 foot, 27 feet a yard, &c.

WINE MEASURE.

231 solid inches make 1 gallon, 2 pints a quart, 40 quarts a gallon, 10 gals. an anker, 18 gals. a runlet, 42 gals. a tierce, 84 gals. a puncheon, 31½ gals. a barrel, 63 gals. a hogshead, 2 hhd. a pipe, 2 pipes a ton.

<i>T. hhd.</i>	<i>gal.</i>	<i>qts.</i>	<i>Tierce.</i>	<i>gal.</i>	<i>qts.</i>	<i>pts.</i>
16	3	62	3	16	41	3
17	2	58	1	17	16	2
16	2	16	3	19	18	0
81	1	18	0	20	17	1
19	1	19	3	61	18	2
16	2	16	2	15	40	1
5	0	0	2	18	23	0

ALE AND BEER MEASURE.

282 solid inches make 1 gallon, 2 pints a quart, 4 qts. a gal. 8 gals. ale, and 9 beer a firkin, 2 firkins a kilderkin, 2 kil: a barrel, 1½ bar. a hogshead.

<i>Kil. fir.</i>	<i>gal.</i>	<i>qts.</i>	<i>pts.</i>	<i>Beer.</i>	<i>K. fir.</i>	<i>gal.</i>	<i>qts.</i>	<i>pts.</i>
16	1	7	3	1	18	1	8	3
17	0	7	2	1	19	1	7	2
68	1	6	1	1	18	1	6	1
18	1	3	1	1	68	1	3	2
18	1	2	2	0	76	0	5	1
99	1	2	1	0	67	1	3	1
99	1	6	2	1	85	0	0	1

DRY MEASURE.

2 pints make 1 quart or qt. 4 qts. a gal. 2 gals. a peck, 4 pecks a bushel, 8 bushels a quarter.

Note, 36 bu. make a chaldron of coals in London, but 32 qts. every where else.

<i>Ch.</i>	<i>bu.</i>	<i>p.</i>	<i>Qrs.</i>	<i>bu.</i>	<i>p.</i>
186	35	3	119	7	3
96	25	2	8198	6	2
17	19	1	6765	3	1
86	18	2	835	2	0
19	16	2	654	2	1
1	16	3	656	1	2
5	18	2	342	1	2

TIME.

60^{'''} thirds make 1 second, 60^{''} seconds a minute, 60 minutes an hour, 24 hours a day, 365 days a year, 365 days, 6 hours, a Julian year, 365 days, 5 hours, 48 minutes, 57 seconds, 39 thirds, a solar year; or, for common use 30 days make 1 month, 7 days a week, 4 weeks a month, 52 weeks a year.

Thirty days hath September, April, June, and November, February hath 28 alone, and all the rest have 31.

MOTION.

60 seconds, or ^{''} make 1 prime minute, 60 minutes, or [°] a degree, 30 degrees a fine, 12 fines or 360 degrees the circle of the zodiac.

SCOTCH TROY, OR DUTCH WEIGHT.

16 drops make an ounce, 16 oz. a pound, 16 lbs. of 760 grains a stone.—Troy weight is nearly the same, only the number of ounces differ in different places for different purposes, from 20 to 28 ounces.

SCOTCH DRY MEASURE.

4 fippies make 1 peck, 4 pecks a firloft, 4 firlofts a boll, 16 bolls a chaldron.

COMPOUND SUBTRACTION.

Compound subtraction produces a difference between sums of divers denominations.*

<i>L.</i>	<i>s.</i>	<i>d.</i>	<i>L.</i>	<i>s.</i>	<i>d.</i>	<i>L.</i>	<i>s.</i>	<i>d.</i>
168	19	11½	98	19	10½	765	16	3½
98	16	10½	58	19	11½	3	19	11½

<i>Tons.</i>	<i>C.</i>	<i>qrs.</i>	<i>lb.</i>	<i>oz.</i>	<i>dr.</i>	<i>Lib.</i>	<i>oz.</i>	<i>dwt.</i>	<i>gr.</i>
9676	19	3	27	15	15	115	11	19	23
769	18	1	22	15	14	89	11	14	22

<i>Yds.</i>	<i>qr.</i>	<i>n.</i>	<i>P.</i>	<i>yd.</i>	<i>f.</i>	<i>in.</i>	<i>Le.</i>	<i>m.</i>	<i>f.</i>	<i>p.</i>
38	1	1	96	1	2	10	26	1	6	20
16	2	3	28	2	1	11	19	2	7	29

<i>Ac.</i>	<i>r.</i>	<i>p.</i>	<i>Ton.</i>	<i>hhd.</i>	<i>gal.</i>	<i>pt.</i>	<i>Days.</i>	<i>h.</i>	<i>m.</i>
16	2	4	16	1	15	7	243	21	18
1	1	3	12	2	16	3	86	23	23

<i>Hhd.</i>	<i>g.</i>	<i>qt.</i>	<i>pt.</i>	<i>Hhd.</i>	<i>g.</i>	<i>qt.</i>	<i>pt.</i>
95	3	1	2	386	1	1	1
1	7	0	3	28	62	3	0

* As an exercise to the scholar he may be desired to subtract a farthing from a L. 1000; a dram from a ton; a grain from a lib.; a scruple from a lib.; a nail from a yard, an ell Flemish or French; a pint from a hhd.; a second from a year, &c. And in order to fix the knowledge of this, or any other subsequent rule surer in his memory, to open his mind, and excite new ideas on the subject, it will not be improper to make him frequently work and prove questions of his own contriving.

Avoirdupoise Weight

Tons C qrs lib oz dr
 178 " 3 " 3 " 27 " 15 " 8
 39 " 16 " 2 " 18 " 10 " 15

Tons C qrs lib oz dr
 1000 " 12 " 1 " 13 " 10 " 2
 1 " 18 " 2 " 0 " 0 " 15

Troy Weight

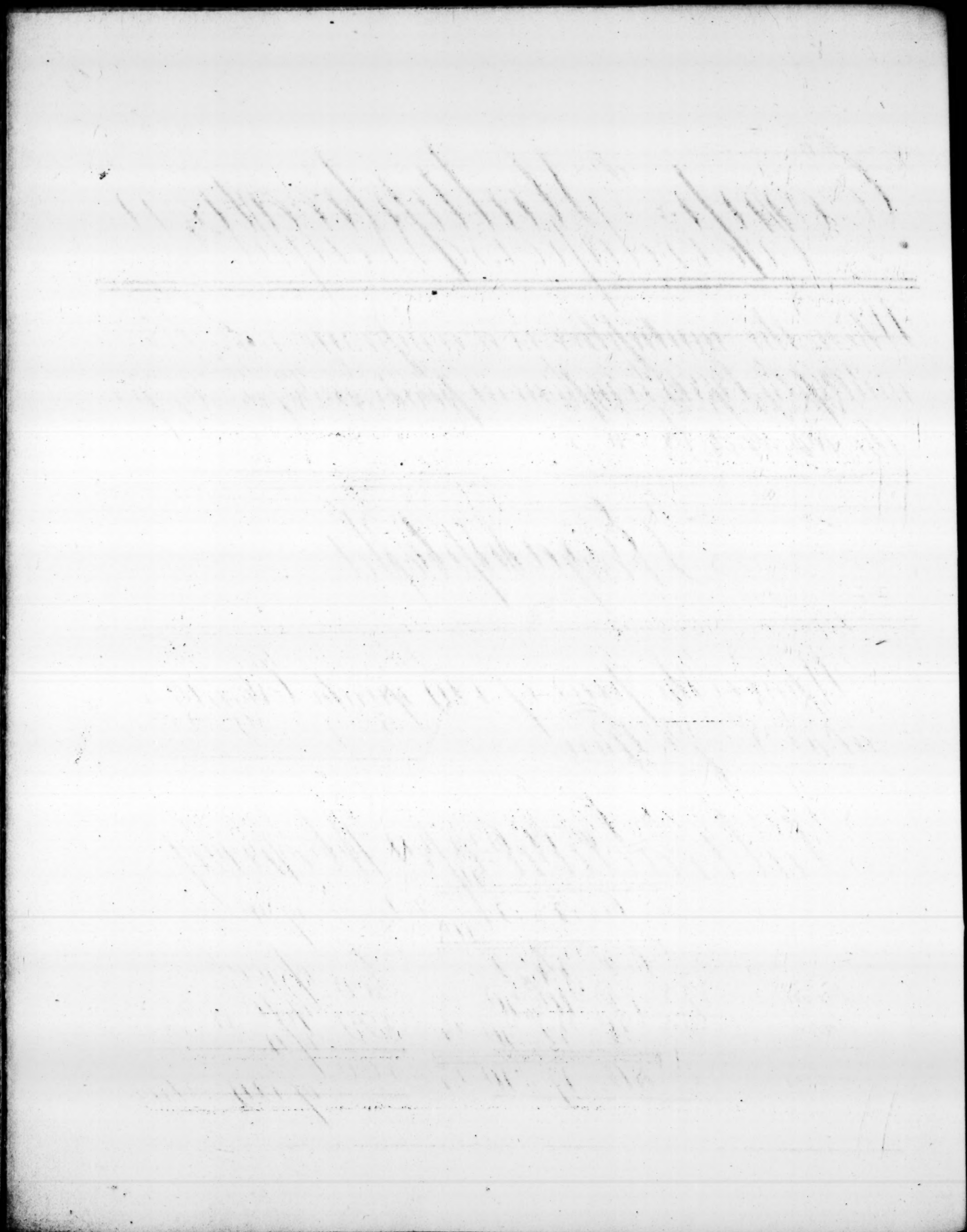
Libs oz dwt gr
 48 " 1 " 1 2
 17 " 11 " 19 " 23

Libs oz dwt gr
 18 " 5 " 16 " 20
 5 " 7 " 19 " 21

Subtraction of Money

From £ S d
 178 " 19 " 11 " $\frac{3}{4}$
 Take 58 " 10 " 11 " $\frac{1}{4}$
 Ans 120 " 9 " $\frac{1}{2}$

£ S d
 300 "
 199 " 19 " 11 " $\frac{3}{4}$
 100 " " $\frac{1}{4}$



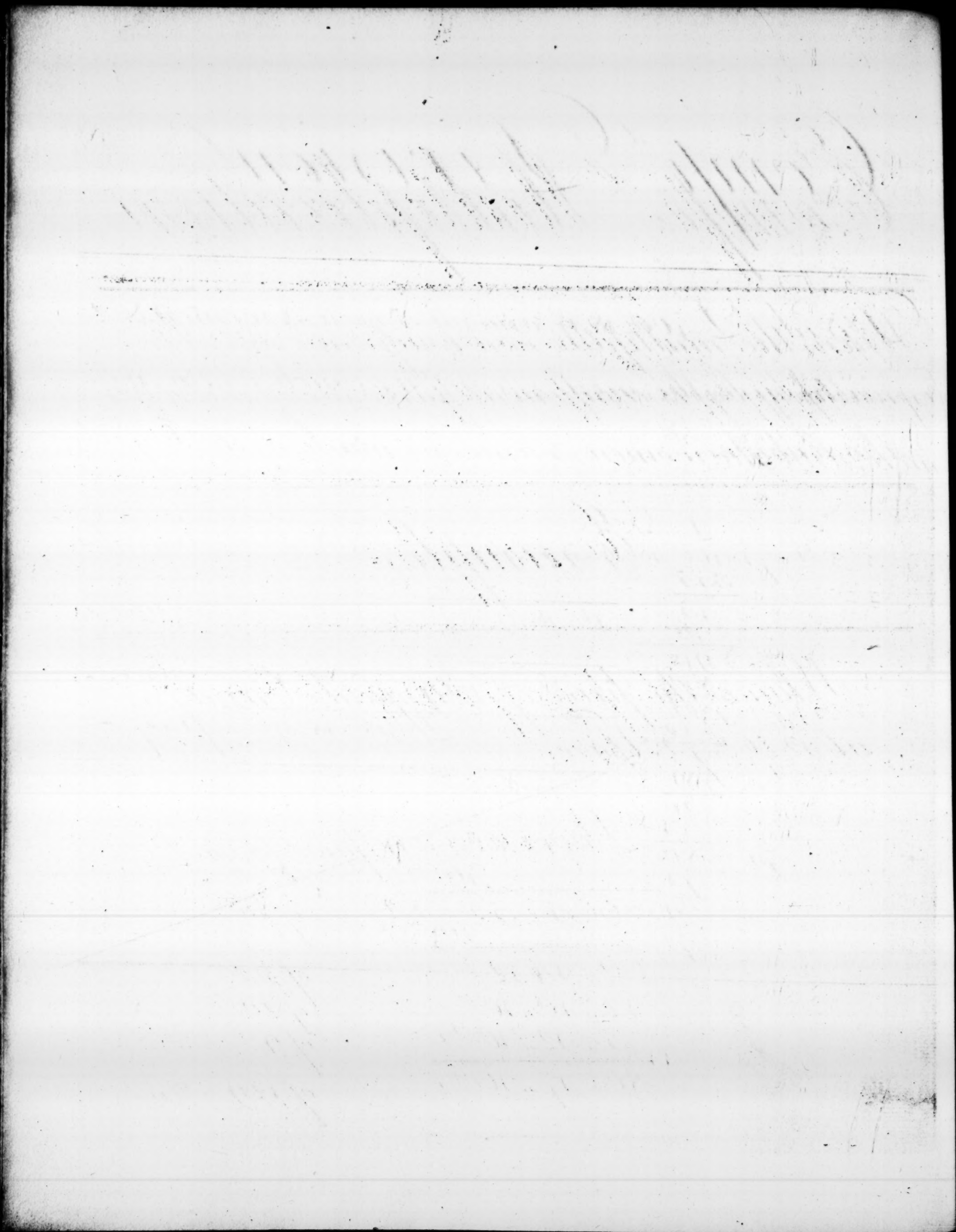
Comp.^d Multiplication

When the multiplier is a composite number;
multiply by its component parts successively for
the answer.

Examples

What is the price of 129 yards Cambric
at $\text{£} 12/6\frac{1}{2}\text{ p.}$ Yard

$\text{£} 0..12..6\frac{1}{2}$	$\times 9$	price of 1 yard
	$\frac{10}{10}$	
$6..5..5$	$\times 2$	of 10
	$\frac{10}{10}$	
$62..14..2$		of 100
$12..10..10$		of 20
$5..12..10\frac{1}{2}$		of 9
$80..17..10\frac{1}{2}$		of 129 Ans.



Comp.^d Division

Divide £400..18..9. among 5 men. 3 women. & 2 boys; and give the men 4 times as much as the women; and the women 3 times as much as the boys.

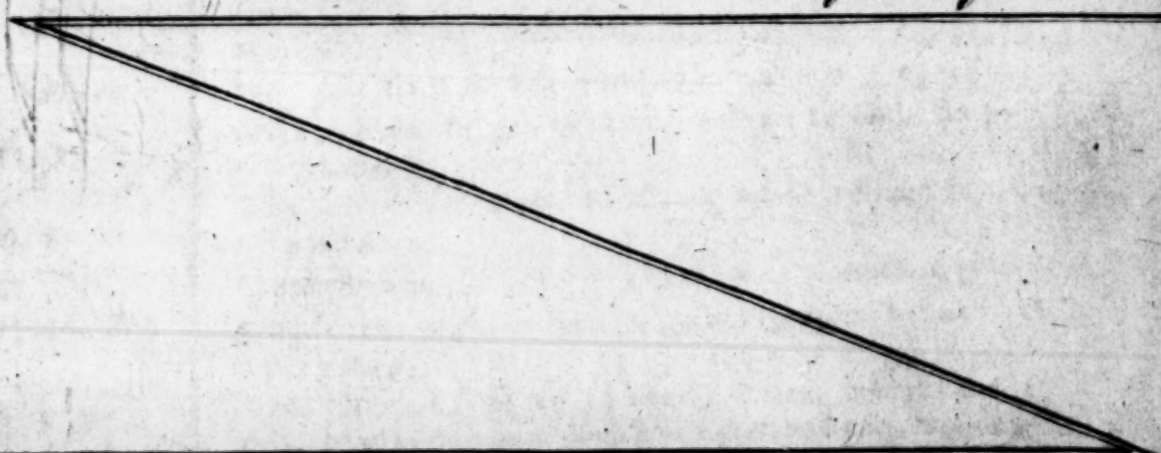
$$5 \times 4 + 3 \times 3 + 2 = 35 \quad \text{£ } 400..18..9 / 35 = 11..5..10\frac{1}{2} \frac{18}{7} \text{ boy's share.}$$

$$\begin{array}{r} 35 \overline{) 400} \\ \underline{35} \\ 45 \\ \underline{35} \\ 10 \\ \underline{70} \\ 30 \\ \underline{28} \\ 2 \\ \underline{20} \\ 0 \end{array}$$

$$11..5..10\frac{1}{2} \frac{18}{7} \times 3 = 33..15..3\frac{1}{4} \frac{54}{7} \text{ women's.}$$

$$11..5..10\frac{1}{2} \frac{18}{7} \times 4 = 44..20..43\frac{1}{4} \frac{72}{7} \text{ men's.}$$

$$\text{£ } 400..18..9 \text{ proof}$$



1871

Dear Sir,

I have the honor to acknowledge the receipt of your letter of the 10th inst.

in relation to the above named matter.

I am sorry to hear that you are unable to visit us at the present time.

1. A Farmer went to market and laid out on cows (a) L.196 16 7½, upon horses (b) L.199 19 6½, upon sheep (c) L.168 13 9½, upon farming utensils (d) L.138 13 6½. I demand how much he brought home of (e) L.1600 19 6, which he took with him? $e - a + b + c + d = L.896 16$.

2. I borrowed from A (a) L.13 19 6½, from B (b) L.19 16, from C (c) L.189 10, from D (d) L.179 12, from E (e) L.133 16 9½, from F (f) L.500 18 9½; my whole property is worth (g) L.11100 12 9. I demand, how much will be left after I pay my debt? $g - a + b + c + d + e + f = L.10062 19 7$.

3. A Merchant has in cash (a) L.469 19 6, goods to the amount of (b) L.3869 10 11½, a house (c) L.800 13 9½, a ship (d) L.1700 13 9½, another (e) L.766 13 9½, a debt due to him (f) L.1800 17 6½. He owes to A (g) L.168, to B (h) L.110 16 9, to C (i) L.169 10 11½. Required his nett stock. $g + h + i - a + b + c + d + e + f = L.8960 1 8$.

4. A Merchant failing, owed to A (a) L.517 8 9½, to B (b) L.876 13 6½, to C (c) L.136 11 3½, to D (d) L.111 11 11½, to E (e) L.1869 17 11½. His effects at that time were as under:—In cash (f) L.300 11 8½, in wares (g) L.1116 13 6½, household furniture (h) L.200 16 8½, and in book debts (i) L.368 16. How much will his creditors lose? $a + b + c + d + e - f + g + h + i = L.1525 5 7½$.

5. Required the nett weight of 5 hhds. sugar, No. 1, (a) 17 cwt. 3 qrs. 16 lib. Tare (b) 3 qrs. 17 lib. No. 2, (c) 6 cwt. 1 qr. 27 lib. Tare (d) 3 qrs. 12 lib. No. 3, (e) 9 cwt. 2 qrs. 11 lib. Tare (f) 1 cwt. 0 qrs. 26 lib. No. 4 (g) 8 cwt. 2 qrs. 12 lib. Tare (h) 3 qrs. 12 lib. No. 5 (i) 7 cwt. 1 qr. 10 lib. Tare (k) 2 qrs. 27 lib. $a + c + e + g + i - b + d + f + h + k = 45$ cwt. 1 qr. 10 lib.

CRITERION.

L.1452 10 3 + L.674 14 1½ + L.596 8 9½ + L.50 3 0 + L.40 2 8½ + L.9 0 0½ + L.0 19 9 + L.0 0 1½ = L.1099 19 8½ = L.1723 19 0½.

COMPOUND MULTIPLICATION.

L 386 13 8½ × 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12.

Cwt. qrs. lib. oz. dr. sc.

36 2 18 × 2, 3, 8, 5 67 7 2 × 7, 6, 8

Lib. oz. dwt. g. Tons. cwt. qrs. lib.

14 6 18 4 × 3, 4, 7, 8 48 18 3 27 × 5, 6, 9

Miles. fu. po. Hbds. gal.

29 3 14 × 4, 7, 9 35 13 × 3, 5, 8, 6, 4

Busb. pe. pts. Years. mo. days.

7 3 2 × 4, 9, 8 3 5 29 × 7, 9, 8, 6.

Day. hours. min. Acres. ro. po.

1 17 48 × 2, 3, 5, 7 4 1 3 × 5, 7, 4, 3

49. L.4 3 8 × 18 or 3 and 6 = L.75 6
50. 1 1 3½ × 28 or 4 and 7 = 29 15 7
51. 0 16 8 × 24 or 4 and 6 = 20 0 0
52. 3 17 9½ × 32 or 4 and 8 = 124 8 8
53. 4 11 1½ × 64 = 291 12 0
54. 3 18 6½ × 96 = 377 0 0

Lib. oz. dwt.

55. (a) 2 11 17 × 196 or (a) × 10 × 10 + (a) × 8 × 12 = 585 lib. 6 oz. 12 dwt.

56. What is the weight of (a) 94 hhds. sugar, each weighing (b) 6 cwt. 2 qrs. 17 lib. 0 oz. 13 dr.?

Cwt. qr. lib. oz. dr.

b × 9 × 10 + b × 4 = 625 1 6 12 6

57. What is the weight of 972 guineas, each (b) 5 dwts. 9 grains? = 21 lib. 9 oz. 4 dwts. 12 gr.

Feet. inches. feet. inches. feet. inches. pts.

12 6 × 2 4 = 29 2 0
16 3 × 5 5 = 88 0 3

62. L.168 18 8½ × 8½ = L.1435 19 0½

63. 56 19 11½ × 5½ = 334 17 4

64. 67 6 11½ × 114½ = 7733 15 8½

CRITERION.

L.168 13 9½ + L.3369 15 0½ + L.10000 10 6½ + L.66 15 8½ + L.16 0 1½ + L.0 0 2½ + L.0 0 0½ = L.999 19 11½ = r × 86½ = L.1093361 3 4½.

COMPOUND DIVISION *.

386 13 8½ ÷ 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
7½ } 14 or 2 and 7 = L.59 18 2½
14 } 16 or 4 and 4 = 52 8 4½
14 } 18 or 3 and 6 = 46 11 11
L.838 } 24 = 34 18 11½
36 = 23 5 11½
72 = 11 12 11½
1728 = 0 9 8½

19. L.96576 19 11½ ÷ 7696 = L.12 10 11½

20. 96756 19 11½ ÷ 87654 = 1 2 0½

21. 96576 19 11½ ÷ 38767 = 2 9 9½

22. 209 hhds. 60 gal. ÷ 14 or 7 and 2 = 14 hhds. 62 gal. 3¼ qts.

23. 1687 cwt. 2 qrs. 26 lib. 15 oz. ÷ 187 = 9 cwt. 0 2 lib. 10 oz.

24. 587 acres, 30 poles ÷ 385 = 1 acre, 2 roods, 4 poles.

25. 986 yards, 2 feet, 6 inches ÷ 86 = 11 yards, 1 foot, 5 in. ⅞

26. Divide L.168 14 9½ among 5 men, 2 boys, and 3 girls, and give each man double of a boy, and each boy double of a girl.

M. B. G.

5 × 2 + 2 × 2 + 3 = 27) L.168 14 9½ (L.6 4 11½ 17 girl's share.

* In this rule, when the questions can be wrought by component parts, it will have a good effect to make the scholar prove them by the long way.

CRITERION.

$$L.385 \ 16 \ 8\frac{1}{2} + L.985 \ 19 \ 7\frac{1}{2} + L.7 \ 6 \ 5 + L.10000 \\ = L.965 \ 13 \ 8\frac{1}{2} = 7 \times 144 = 1008 \div 57\frac{1}{2} = L.24578 \ 16 \ 11$$

INTEREST.

To find the interest on any sum for any time at 5 per cent. multiply the principal (or money at interest) by the number of days given, then divide the product by 365, and the quotient will be the interest or answer in shillings; or, divide the quotient by 7300, and the answer will come out pounds. For proof do each question both ways.

EXAMPLES.

- 1st, What is the interest of L.100 for 50 days?
Ans. L.0 13 8 $\frac{1}{2}$ 11
- 2d, of L.300 for 20 days?
Ans. L.0 16 5 $\frac{1}{2}$ 7
- 3d, of L.30 for 90 days?
Ans. L.0 7 4 $\frac{1}{2}$ 7
- 4th, of L.80 from 1st June to 1st January?
Ans. L.2 6 10 $\frac{1}{2}$ 3
- 5th, of L.10 from 2d July to January 4th?
Ans. L.0 5 1 $\frac{4}{7}$ 7
- 6th, of L.60 from June 3d, 97, to August 4th, 98?
Ans. L.3 10 2 $\frac{1}{2}$ 7
- 7th, of L.90 from May 4th, 96, to April 2d, 97?
Ans. L.4 2 1 $\frac{1}{4}$ 7

To find the amount add the interest found to the principal, or sum lent.

EXAMPLES.

- 8th, What is the amount of L.500 for 88 days?
Ans. L.506 0 6 $\frac{1}{2}$ 3
- 9th, of L.50 for 268 days?
Ans. L.51 16 8 $\frac{1}{2}$ 14
- 10th, of L.30 for 300 days?
Ans. L.31 4 7 $\frac{1}{2}$ 11
- 11th, of L.20 for 320 days?
Ans. L.20 17 6 $\frac{1}{4}$ 7

To find the interest at any other rate per cent. find the interest at 5 per cent. and multiply it by the rate per cent. given, then divide the product by 5 per cent. which will quote the true interest.

REDUCTION

Consists of three kinds, viz. Descending, Ascending, and Mixt. It teaches to bring one denomination into another,

* Common computations in this rule being so simple and so useful, made it an inducement to offer a few questions at this early stage of the course, in order to familiarize them to the scholar, and for the benefit of such as may not be able to reach it where it is commonly placed.

without altering the intrinsic value. It descends when it brings a better to a worse, as when pounds are reduced to shillings; and ascends when a worse is brought to a better, as when farthings are brought to pounds, &c.; it is mixt when it ascends and descends in the same question.

EXAMPLES IN MONEY, DESCENDING.

- In (a) 8676 pounds how many shillings, pence, and farthings? $a \times 20 \times 12 \times 4 = 8328960$ farthings.
- In (a) 86976 moidores, how many shillings, pence, and farthings? $a \times 27 \times 12 \times 4 = 112720896$ farthings.
- In (a) 68799 guineas how many farthings?
 $a \times 21 \times 12 \times 4 = 69349392$ farthings.
- In (a) 769856 crowns how many farthings?
 $a \times 5 \times 12 \times 4 = 184765440$ farthings.
- In (a) L.896 16 8 $\frac{1}{2}$ how many halfpence?
 $a \times 20 + 16 \times 12 + 8 \times 2 + 1 = 430481$ halfpence.
- Reduce L.3 16 8 $\frac{1}{2}$ into farthings. *Ans.* 3681 farth.
- In 8696 moidores, 17 shillings, 8 pence, how many halfpence? *Ans.* 5635432 halfpence.
- In 500 guineas how many crowns, shillings, groats, twopences, pence, and farthings? *Ans.* 504000 farthings.
- In 85 half guineas, 7 sixpences, how many farthings? *Ans.* 43008 farthings.
- In 687 moidores, 576 guineas, 300 joanneses, 689 quarter guineas, 186 pistoles, 26 groats, 33 sixpences, 46 pence, 600 nobles, how many farthings? *Ans.* 2508156 farthings.

ASCENDING.

- In (a) 272640 farthings, how many pounds? $a \div 4 \div 12 \div 20 = 284$ pounds.
- In (a) 4684 pence, how many guineas? $a \div 12 \div 21 = 18$ guineas, 12 shillings, 4 pence.
- In (a) 7489076 halfpence, how many shillings, crowns, and pounds? $a \div 2 \div 12 \div 5 \div 4 = L.15602$ 0 crowns, 4 shillings, 10 pence.
- In (a) 146581 sixpences, how many crowns and pounds? $a \div 10 \div 4 = L.3664$ 2 6.
- In (a) 17280 farthings, how many pence, threepences, and sixpences? $a \div 4 \div 3 \div 2 = 720$ sixpences.
- In (a) 768450 pence, how many twopences, groats, shillings, and guineas? $a \div 2 \div 2 \div 3 \div 21 = 3049$ guineas, 8 shillings, 1 groat, 2 pence.
- In (a) 75346780 farthings, how many pence, twopences, groats, shillings and pounds? $a \div 4 \div 2 \div 2 \div 3 \div 20 = L.78486$ 4 shillings, 1 groat, 1 twopence, 1 penny.
- In (a) 4580637 farthings, how many pence, sixpences, shillings, and crowns? $a \div 4 \div 6 \div 2 \div 5 = 19085$ crowns, 4 shillings, 1 sixpence, 5 $\frac{1}{2}$ pence.
- In (a) 307650 pence, how many shillings and guineas? $a \div 12 \div 21 = 1220$ guineas, 17 shillings, 6 pence.
- In (a) 20573394 groats, how many shillings and half

Reduction Ascending

Examples

In 576589 Farthings how many Pence,
Shillings, and Pounds?

4	576589	
12	144147	$\frac{1}{4}$ pence.
20	12012	$3\frac{1}{4}$ Shill.
	600	12 3 $\frac{1}{4}$ pounds.

In 8565450 Cunces how many Cwt.?

16	{	4	8565450	}	
		4	2141362..2		
28	{	4	535340..2	}	10 lb.
		7	133835..		
		4	19119..2		8..10 grs.
			47 $\frac{1}{9}$ 9..3..		8..10. Cwt. Ans.

[Faint, illegible handwriting, likely bleed-through from the reverse side of the page.]

[Faint, illegible handwriting, likely bleed-through from the reverse side of the page.]

Mixt Reduction

In £496..17..6 how many Shillings. Sixpences.
Crowns. Halfcrowns. and Threepences?

	£	SD	
	496	17	6
	20		
	95	3	$\frac{7}{2}$
			Shillings.
10	190	7	$\frac{5}{2}$
			Sixpences.
	190	7	$\frac{2}{2}$
			Crowns.
	38	1	$\frac{5}{2}$
			Halfcrowns.
		10	
	38	1	50
			Threepences.

In 6734 French crowns how many Ric-dollars
of Hamburg. valuing the crowns at $\frac{2}{3}$ &
the dollars at $\frac{4}{6}$?

$$6734 \times 9 = 60606 \div 18 = 3367 \text{ R.Dollars.}$$

[Faint, illegible handwriting in the top section of the page]

[Faint, illegible handwriting in the middle section of the page]

[Faint, illegible handwriting in the bottom section of the page]

guineas? $a \div 3 \times 2 \div 21 = 653123$ half guineas, 6 shillings, 6 pence.

11 In (a) 6513550 farthings how many halfpence, pence, shillings, and pounds? $a \div 2 \div 2 \div 12 \div 20 = L. 6784$ 18 11½.

12 In (a) 7637 shillings, (b) 534890 farthings, (c) 7640 halfpence, how many pounds?

	L.	s.	d.
a=	381	17	0
b=	557	3	6½
c=	15	18	4

L:954 18 10½

MIXT REDUCTION.

1 In (a) 84268974 half guineas, how many fixpences and moidores? $a \times 21 \div 54 = 32771267$ moidores, 18 shillings.

2 In (a) 36747835 joannefes, how many crowns, fourpences, and twopences? $a \times 36 \div 5 \times 15 \times 2 = 7937532360$ twopences.

3 In (a) 65764926 jacobuses, how many joannefes and guineas? $a \times 25 \div 36 \times 36 \div 21 = 78291578$ guineas, 12 shill.

4 In (a) 89567462 marks, how many fourpences and crowns? $a \times 40 \div 15 = 238846565$ crowns, 1 shilling, 8 pence.

5 In (a) 6594324 quarter guineas, how many nobles? $a \times 63 \div 80 = 5193030$ nobles, 1 shilling.

6 In (a) 5439264 pounds, how many crowns, half crowns, and fixpences? $a \times 4 \times 2 \times 5 = 13598160$ fixpences.

7 In 7965484 angels, how many crowns, half crowns, and twopences? *Ans.* 119482260 twopences.

8 In 6423789 moidores, how many jacobuses? *Ans.* 6937692 jacobuses, 3 shillings.

9 In 8594624 marks, how many nobles? *Ans.* 17189248 nobles.

10 In 89765442 caroluses how many joannefes? *Ans.* 57350143, 18 shillings.

11 In 1918442 groats, how many shillings, moidores, and farthings? *Ans.* 30695072 farthings, 23684 moidores, 12 shillings, 8 pence.

12 In L.8411 how many guineas and fixpences? *Ans.* 336440 fixpences, 8010 guineas, 20 shillings.

13 In (a) 764358 jacobuses how many (b) crowns, (c) twopences, (d) shillings, (e) fixpences, (f) fourpences, and of each an equal number? $a \times 25 \times 12 \div b + c + d + e + f = 2729850$.

14 In (a) 7896543 joannefes, how many (b) marks, (c) nobles, (d) shillings, and (e) moidores, and of each an equal number? $a \times 36 \times 12 \div b + c + d + e = 5922407$ 12 shillings.

15 How many moidores, nobles, crowns, shillings, and guineas, are in 7369845 joannefes? *Ans.* 12634020 guineas, 265314420 shillings, 9826460 moidores, 39797163 nobles, 53062884 crowns.

16 How many fixpences, shillings, groats, and pence, are in 45680760 pounds? *Ans.* 10963382400 pence, 2740845600 groats, 913615200 shillings, 1827230400 fixpences.

17 In (a) 147680 crowns, how many twopences, shillings, quarter guineas, and nobles? *Ans.* 110760 nobles, 8860800 pence, 140647½ quarter guineas, 738400 shillings, 4430400 twopences.

18 A Gentleman made a purchase which cost him as under: (a) 46 caroluses, (b) 3450 crowns, (c) 900 joannefes (d) 40 jacobuses, (e) 9495 guineas, (f) 9840 moidores, (g) 764 pistoles, each 17s. 6d. (h) 67400 nobles, (i) 760 dollars, each 4s. 6d. (j) 7000 twenty shilling notes, (k) 800 five shilling notes. I demand what his estate cost him in sterling money? $a = L.52$ $18 + b = L.862$ $10 + c = L.1620$ $+ d = L.50$ $+ e = L.9969$ $15 + f = L.13284$ $+ g = L.668$ 10 $h = L.22466$ 13 $4 + i = L.171$ $+ j = L.7000$ $+ k = L.200$ $= L.56345$ 6 4 total sum.

REDUCTION OF AVOIRDUPOISE WEIGHT.

1 In (a) 748 cwt. 3 qrs. and 24 lib. how many pounds? $a \times 4 + 3 \times 28 + 24 = 83884$ lbs.

2 In 654 cwt. 2 qrs. 16 lib. 8 ounces, how many ounces? *Ans.* 1173128 oz.

3 In 78460 ounces, how many pounds, quarters, cwts. and tons? *Ans.* 2 tons, 3 cwt. 3 qrs. 3 lbs. 12 oz.

4 In 376 cwt. 2 qrs. 10 lbs. 6 oz. and 4 drams, how many drams? *Ans.* 10797668 drams.

5 In 14678050 drams how many lbs. qrs. cwts. and tons? *Ans.* 25 tons, 11 cwt. 3 qrs. 20 lib. 2 oz. 2 dr.

6 In 4 tons, 7 cwt. 3 qrs. 20 lib. 12 oz. 10 dr. how many drams? *Ans.* 2521290 drams.

7 Suppose 90 tons of sugar to be made up into hogsheds, tierces, barrels and half barrels, each hhd. to contain 8 cwt. 1 qr. 26 lbs. each tierce 5 cwt. 2 qrs. 16 lbs. each barrel 4 cwt. 2 qrs. 1 lib. each half do. 2 cwt. 3 qrs. 27 lib. how many would it require, of each an equal number? *Ans.* 83 ¼ of each sort.

REDUCTION OF TROY WEIGHT.

1 In (a) 764 lbs. 4 ounces, 13 dwts. how many pennyweights? $a \times 12 + 4 \times 20 + 13 = 183453$ dwts.

2 In 62 lbs. 7 ounces, 4 dwts. 3 grains, how many grains? *Ans.* 360579 grains.

3 In 1467850 grains how many pennyweights, ounces and pounds? *Ans.* 254 lbs. 10 oz. 0 dwt. 10 grains.

4 A Goldsmith having 4 ingots of silver, each 24 ounces, is minded to make them into bowls of 1 lib. 9 oz. per bowl, and spoons of 2 oz. per spoon, and salts of 5 oz. 4 dwts. and of each an equal number, how many of each sort will there be? *Ans.* 3 ⅔ of each sort.

5 In 7680 grains of gold, how many dwts. oz. and pounds? *Ans.* 1 lib 4 oz.

6 In (a) 19 lbs. of silver, how many table silver spoons, each (b) 1 oz. 16 dwts.? $a \times 12 \times 20 \div b = 126 \frac{1}{2}$ ½.

REDUCTION OF DRY MEASURE.

- 1 In (a) 392 qrs. 1 peck, 1 gallon, how many gallons?
 $a \times 8 + 0 \times 4 + 1 \times 2 + 1 = 2509$ gallons.
- 2 In 146 quarters, 3 bushels, 2 pecks, 1 gallon, how many gallons? *Ans.* 9373 gallons.
- 3 In 1246870 gallons, how many quarters? *Ans.* 19482 quarters, 2 bushels, 3 pecks.
- 4 In 127650 lippies, how many chaldrons? *Ans.* 124 chaldrons, 10 bu. 2 f. 0 p. 2 lip.
- 5 In (a) 1 load how many pints? $a \times 40 \times 4 \times 2 \times 4 \times 2 = 2560$ pints.
- 6 In 14620 chaldrons how many pecks? *Ans.* 2105280 pecks.

REDUCTION OF WINE MEASURE.

- 1 In (a) 148 hogheads of wine how many gallons, quarts and pints? $a \times 63 \times 4 \times 2 = 74592$ pints.
- 2 In 74 hogheads, 14 gallons, 2 quarts and 1 pint, how many pints? *Ans.* 37413 pints.
- 3 In 146728 pints how many tons? *Ans.* 72 tons, 3 hhds. 8 gal.
- 4 In 378 ankers of wine how many barrels? *Ans.* 120 barrels.
- 5 In 768 tierces how many runlets and hogheads? *Ans.* 512 hogheads.

REDUCTION OF BEER MEASURE.

- 1 In (a) 124 butts of beer how many gallons?
 $a \times 2 \times 54 = 13392$ gallons.
- 2 In 728 hogheads how many quarts and pints? *Ans.* 314496 pints.
- 3 In (a) 374 kilderkins how many butts? $a \times 2 \times 4 \div 48 = 62$ butts, 1 barrel.
- 4 In 17128 gallons how many tons? *Ans.* 79 tons, 1 hhd. 10 gallons.

REDUCTION OF CLOTH MEASURE.

- 1 In (a) 1478 nails how many yards? $a \div 4 \div 4 = 92$ yards, 1 qr. 2 nails.
- 2 In (a) 328 ells Flemish how many ells English?
 $a \times 3 \div 5 = 196$ ells English, 4 qrs.
- 3 In 124 yards, 1 quarter, 1 nail, how many nails? *Ans.* 1989 nails.
- 4 In 142 ells Flemish how many quarters and nails? *Ans.* 1704 nails.
- 5 In 3450 ells French how many Scotch ells? *Ans.* 5008 ells $\frac{2}{3}$ inches.
- 6 In 47189 ells English how many ells French? *Ans.* 39324 ells, 1 qr.

REDUCTION OF LONG MEASURE.

- 1 In (a) 371 miles how many barley corns? $a \times 1760 \times 3 \times 12 \times 3 = 70519680$ barley corns.
- 2 In 1845116 barley corns how many miles? *Ans.* 9 miles, 5 furlongs, 26 poles, 1 yard, 1 foot, 2 in. 2 b. c.
- 3 In 288 miles how many furlongs, poles, yards, and feet? *Ans.* 1520640 feet.
- 4 How many strokes will it take to row a boat over betwixt Dover and Calais, being 21 miles, at 4 feet every stroke? *Ans.* 27720 strokes.

OF TIME.

- 1 In (a) 1763820 seconds how many hours? $a \div 60 \div 60 = 489$ hours, 57 minutes.
- 2 How many seconds in a year, allowing the year to consist of 365 days, 6 hours? *Ans.* 31557600 seconds.
- 3 How many seconds is it since the Revolution of (a) 1688 to 1797? $a \times 365 \times 6 \times 24 \times 60 \times 60 = 3439778400$.

RULE OF THREE

Consists of Single and Compound, Direct and Inverse.—In questions of the Single Rule of Three, three terms are given to find a fourth; of these three, two are always of the same kind, and the other the same of the answer.—As for example, in the first question, two of the three given terms are yards, and the other money, which is the same kind with the answer, or fourth term.

To arrange, or state the question, let it be first understood that the signs made use of are read thus, as 2 : is to 4 :: 10 is 8 : to 16.

First find that term which is of the same kind with the answer, and set it down with two points before it, and four after it, (marking the sign of the kind above the figures.) Then study the nature of the question, and find out whether the answer is to be greater or less than the middle term—if greater, then the greatest of the two remaining terms is placed on the right hand, and the least on the left; this is Direct Proportion: but if less, then the least goes to the right, and the greatest to the left; this is called Inverse. Next, if the terms are composed of different denominations, observe that the middle ones must be reduced to the lowest denomination given in it, and the first and last to the same denomination with each other: as for example, if the middle term be L. 4 16 8 $\frac{1}{2}$, it must be brought to halfpence, because halfpence is the lowest denomination given. Or, supposing the first term to be 4 cwt. 3 qrs. 28 lib., and the last 15 oz. 13 dr., both of these terms are to be brought to the same denomination, or in other words, to drams, because drams is the lowest denomination given; this is called preparing the state; after which the second and third are to be multiplied into one another, and divided by the first, which quotes the answer in

Rule of Three

Examples

What is the value of $14 \frac{3}{5}$ ell English at £16..5
for 27 ell French?

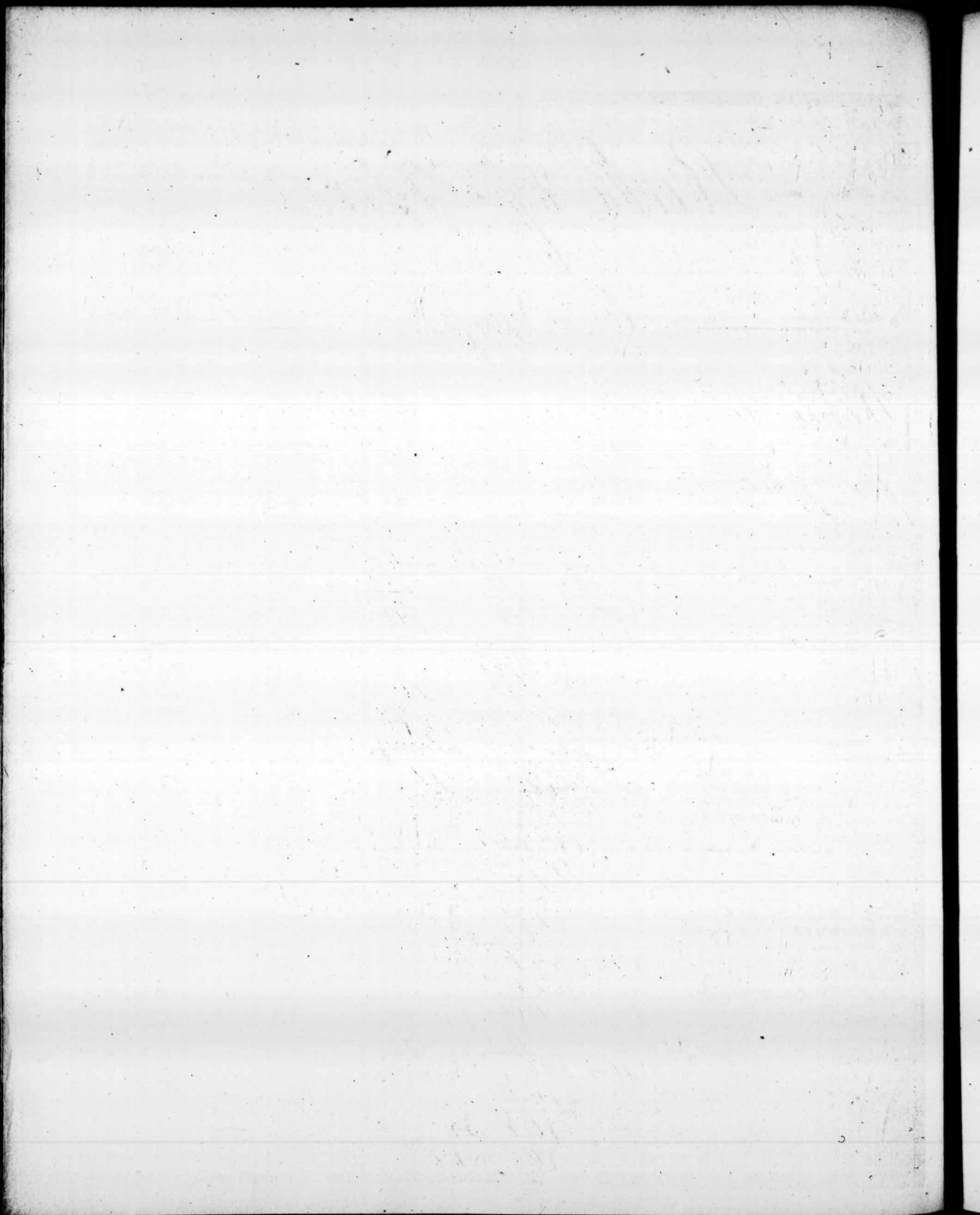
$$\begin{array}{r} \text{ff} \quad 27 : 16..5 :: 14 \frac{3}{5} : \\ \hline 162 \quad 325 \quad 73 \end{array}$$

$$\begin{array}{r} 22 \frac{7}{5} \quad 2/0 \\ 162 \overline{) 23725} \quad \overline{) 146} \\ \underline{162} \quad \underline{7} \quad 6 \quad 5 \frac{1}{4} \frac{51}{81} \text{ Ans.} \\ 752 \end{array}$$

$$\begin{array}{r} 1648 \\ \underline{1045} \\ 972 \\ \underline{73} \\ 12 \end{array}$$

$$\begin{array}{r} 162 \overline{) 876} \quad 5 \\ \underline{810} \\ 66 \\ 4 \end{array}$$

$$\begin{array}{r} 162 \overline{) 264} \quad 1/4 \\ \underline{162} \\ 102 \quad 51 \\ \underline{162} \quad 81 \end{array}$$



the same name the middle term was reduced to; as in the above example the middle term was reduced to halfpence, consequently the answer must come out halfpence, which must ascend to pounds by Reduction, or in other words, by dividing by 2, by 12, and by 20.

To prove questions in this rule, say, as the last term : the answer :: the first term to the middle, or as the middle term : the first, :: the answer to the last.

Note 1st, When it can be done *easily*, multiply and divide as in Compound Multiplication and Division—Or, divide the second term by the first, and multiply the quotient into the third for the answer—Or divide the third term by the first, and multiply the quotient into the second for the answer—Or divide the first term by the second, and the third by that quotient for the answer—Or divide the first term by the third, and the second by that quotient for the answer.

2d, Direct Proportion may be proved by multiplying the first term into the third, which will be equal to the product of the second and the answer; or, in Reciprocal Proportion, when like terms are placed together in the arrangement, as is frequently taught, the product of the first and second terms will be equal to that of the third and fourth*.

EXAMPLES

Whose terms consist only of one denomination.

1st, If (a) 24 yards of cloth cost (b) L.36, what cost (c) 144 yards at the same price?

$$\begin{array}{r} \text{yds} \quad L \quad \text{yds} \quad L \\ \text{If } a : b :: c : 216 \end{array}$$

For proof, if $c : 216 :: a : b$ or if $b : a :: 216 : c$

2d, If (a) 17 cwt. pepper cost (b) L.85, what will (c) 168 cwt. cost?

$$\begin{array}{r} \text{cwt} \quad L \quad \text{cwt} \quad L \\ \text{If } a : b :: c : 840 \end{array}$$

3d, If (a) 15 cwt. tobacco cost (b) L.86, what will (c) 3 cwt. cost?

$$\begin{array}{r} \text{c} \quad L \quad \text{c} \quad L \\ \text{If } a : b :: c : L.17 \quad 4 \end{array}$$

4th, If (a) 12 hogsheads of sugar, each (b) 9 cwt, cost (c) L.300, what is the price of a (d) cwt.?

$$\begin{array}{r} \text{cwt} \quad L \quad \text{cwt} \quad L \\ \text{If } a \times b : c :: d : L.2 \quad 15 \quad 6\frac{1}{2} \quad 1\frac{3}{4} = 6 \end{array}$$

5th, If (a) 12 boxes, containing (b) 20 bales, each bale (c) 50 yards, cost at the rate of (d) L.3 per (e) yard, what will the whole cost?

$$\begin{array}{r} \text{yds} \quad L \quad \text{bales} \quad \text{yds} \quad L \\ \text{If } e : d :: a \times b \times c : 36000 \end{array}$$

Prepare the States of the following Questions by Reduction Descending, as they consist of different denominations.

6th, If (a) 14 yards, 3 qrs. cost (b) L.40 16 8 $\frac{1}{2}$, what

* This rule being one of the most useful in every business, it's principles and properties ought to be much studied by every person who has any thing to do with Arithmetic.

It is hoped, if the general rule be well understood, that no inconveniency will arise to the learner from mixing direct and inverse questions indiscriminately together.

will (c) 10 bales, each bale (d) 30 yards, 3 qrs. cost at that rate?

grs farth bales grs

$$\text{If } a : b :: c \times d : L.851 \quad 5 \quad 10\frac{1}{2} \quad 1\frac{1}{2}$$

7th, If (a) 1 qr. of a yard cost (b) 5s. 3 $\frac{1}{2}$ d., what will (c) 50 boxes, containing (d) 30 pieces, each piece (e) 30 yards, 3 qrs. 1 nail, cost at that rate?

na farth box piec nails

$$\text{If } a : b :: c \times d \times e : L.48914 \quad 16 \quad 10\frac{1}{2}$$

8th, (a) 5 ships arrive from the West Indies, each having on board (b) 250 puncheons of rum, and (c) 50 hogsheads of sugar, each hhd. containing (d) 8 cwt. 1 qr. 27 lbs. Tare, (e) 26 lbs. per hhd. The rum was sold at the rate of (f) 12s. 6d. per (g) gallon, and the sugar at the rate of (h) 5s. 6d. per (i) 7 lib. what did the whole amount to?

lib d lib bhd lb lib bhd lb

$$\text{If } i : h :: d \times c \times a - e \times c \times a : L.9084 \quad 16 \quad 5\frac{1}{2}$$

ga d pu lb gal

$$\text{If } g : f :: b \times a \times 84 : 65625 \quad 0 \quad 0$$

Total amount of the cargo, 74709 16 5 $\frac{1}{2}$

9th, A Gentleman purchased an estate containing (a) 10 inclosures of arable land, each inclosure containing (b) 15 acres, 3 roods, for which he paid at the rate of (c) L.199 19 8 $\frac{1}{2}$, for (d) 3 acres and 1 rood; with a piece of meadow ground containing (e) 13 acres, 2 roods, for which he paid at the rate of (f) L.10 for every (g) 3 roods, what did the estate cost him?

roods farth roods inclos

$$\text{If } d : c :: b \times a : L.9691 \quad 13 \quad 0\frac{1}{2} \quad 1\frac{1}{2}$$

roods L roods

$$\text{If } g : f :: e : 180 \quad 0 \quad 0$$

$$9871 \quad 13 \quad c\frac{1}{2} \quad r\frac{1}{2}$$

10th, A Gentleman has an estate which brings him yearly (a) L.987 6 3 $\frac{1}{2}$, and a finecure place under government of (b) L.250 per annum, I demand what he reserves every (c) year, supposing his family expences amount to (d) 18s. 6 $\frac{1}{2}$ per (e) day, and his pocket expences cost him (f) L.10 10 per (g) month?

day d days

$$\text{If } e : d :: c : L.338 \quad 7 \quad 8\frac{1}{2}$$

mo lb mo

$$\text{If } g : f :: c : 126 \quad 0 \quad 0$$

$$a+b-464 \quad 7 \quad 8\frac{1}{2} = L.772 \quad 18 \quad 7\frac{1}{2}$$

11th, Two Grocers, A and B, make a purchase of (a) 10 hogsheads of sugar, each weighing neat (b) 7 cwt. 3 qrs 16 lib. for which they paid at the rate of (c) L.2 18 6 per (d) cwt. I demand what quantity A paid for, and how much B got, who paid (e) L.167 16 9 $\frac{1}{2}$ for his part?

$$\text{If } d : c :: a \times b : L.230 \quad 17 \quad 3\frac{1}{2} \quad \frac{1}{4} \text{ total cost.}$$

$$\text{If } e : d :: e : 57 \text{ cwt. } 1 \text{ qr. } 14 \text{ lib. } \frac{1}{4} \frac{1}{8} \frac{1}{16} \frac{1}{32} \frac{1}{64} \frac{1}{128} \frac{1}{256} \frac{1}{512} \frac{1}{1024} \frac{1}{2048} \frac{1}{4096} \frac{1}{8192} \frac{1}{16384} \frac{1}{32768} \frac{1}{65536} \frac{1}{131072} \frac{1}{262144} \frac{1}{524288} \frac{1}{1048576} \frac{1}{2097152} \frac{1}{4194304} \frac{1}{8388608} \frac{1}{16777216} \frac{1}{33554432} \frac{1}{67108864} \frac{1}{134217728} \frac{1}{268435456} \frac{1}{536870912} \frac{1}{1073741824} \frac{1}{2147483648} \frac{1}{4294967296} \frac{1}{8589934592} \frac{1}{17179869184} \frac{1}{34359738368} \frac{1}{68719476736} \frac{1}{137438953472} \frac{1}{274877906944} \frac{1}{549755813888} \frac{1}{1099511627776} \frac{1}{2199023255552} \frac{1}{4398046511104} \frac{1}{8796093022208} \frac{1}{17592186044416} \frac{1}{35184372088832} \frac{1}{70368744177664} \frac{1}{140737488355328} \frac{1}{281474976710656} \frac{1}{562949953421312} \frac{1}{1125899906842624} \frac{1}{2251799813685248} \frac{1}{4503599627370496} \frac{1}{9007199254740992} \frac{1}{18014398509481984} \frac{1}{36028797018963968} \frac{1}{72057594037927936} \frac{1}{144115188075855872} \frac{1}{288230376151711744} \frac{1}{576460752303423488} \frac{1}{1152921504606846976} \frac{1}{2305843009213693952} \frac{1}{4611686018427387904} \frac{1}{9223372036854775808} \frac{1}{18446744073709551616} \frac{1}{36893488147419103232} \frac{1}{73786976294838206464} \frac{1}{147573952589676412928} \frac{1}{295147905179352825856} \frac{1}{590295810358705651712} \frac{1}{1180591620717411303424} \frac{1}{2361183241434822606848} \frac{1}{4722366482869645213696} \frac{1}{9444732965739290427392} \frac{1}{18889465931478580854784} \frac{1}{37778931862957161709568} \frac{1}{75557863725914323419136} \frac{1}{151115727451828646838272} \frac{1}{302231454903657293676544} \frac{1}{604462909807314587353088} \frac{1}{1208925819614629174706176} \frac{1}{2417851639229258349412352} \frac{1}{4835703278458516698824704} \frac{1}{9671406556917033397649408} \frac{1}{19342813113834066795298816} \frac{1}{38685626227668133590597632} \frac{1}{77371252455336267181195264} \frac{1}{154742504910672534362390528} \frac{1}{309485009821345068724781056} \frac{1}{618970019642690137449562112} \frac{1}{1237940039285380274899124224} \frac{1}{2475880078570760549798248448} \frac{1}{4951760157141521099596496896} \frac{1}{9903520314283042199192993792} \frac{1}{19807040628566084398385987584} \frac{1}{39614081257132168796771975168} \frac{1}{79228162514264337593543950336} \frac{1}{158456325028528675187087900672} \frac{1}{316912650057057350374175801344} \frac{1}{633825300114114700748351602688} \frac{1}{1267650600228229401496703205376} \frac{1}{2535301200456458802993406410752} \frac{1}{5070602400912917605986812821504} \frac{1}{10141204801825835211973625643008} \frac{1}{20282409603651670423947251286016} \frac{1}{40564819207303340847894502572032} \frac{1}{81129638414606681695789005144064} \frac{1}{162259276829213363391578010288128} \frac{1}{324518553658426726783156020576256} \frac{1}{649037107316853453566312041152512} \frac{1}{1298074214633706907132624082305024} \frac{1}{2596148429267413814265248164610048} \frac{1}{5192296858534827628530496329220096} \frac{1}{10384593717069655257060992658440192} \frac{1}{20769187434139310514121985316880384} \frac{1}{41538374868278621028243970633760768} \frac{1}{83076749736557242056487941267521536} \frac{1}{166153499473114484112975882535043072} \frac{1}{332306998946228968225951765070086144} \frac{1}{664613997892457936451903530140172288} \frac{1}{1329227995784915872903807060280344576} \frac{1}{2658455991569831745807614120560689152} \frac{1}{5316911983139663491615228241121378304} \frac{1}{10633823966279326983230456482242756608} \frac{1}{21267647932558653966460912964485513216} \frac{1}{42535295865117307932921825928971026432} \frac{1}{85070591730234615865843651857942052864} \frac{1}{170141183460469231731687303715884105728} \frac{1}{340282366920938463463374607431768211456} \frac{1}{680564733841876926926749214863536422912} \frac{1}{1361129467683753853853498429727072845824} \frac{1}{2722258935367507707706996859454145691648} \frac{1}{5444517870735015415413993718908291383296} \frac{1}{10889035741470030830827987437816582766592} \frac{1}{21778071482940061661655974875633165533184} \frac{1}{43556142965880123323311949751266331066368} \frac{1}{87112285931760246646623899502532662132736} \frac{1}{174224571863520493293247799005065324265472} \frac{1}{348449143727040986586495598010130648530944} \frac{1}{696898287454081973172991196020261297061888} \frac{1}{1393796574908163946345982392040522594123776} \frac{1}{2787593149816327892691964784081045188247552} \frac{1}{5575186299632655785383929568162090376495104} \frac{1}{11150372599265311570767859136324180752990208} \frac{1}{22300745198530623141535718272648361505980416} \frac{1}{44601490397061246283071436545296723011960832} \frac{1}{89202980794122492566142873090593446023921664} \frac{1}{178405961588244985132285746181186892047843328} \frac{1}{356811923176489970264571492362373784095686656} \frac{1}{713623846352979940529142984724747568191373312} \frac{1}{1427247692705959881058285969449495136382746624} \frac{1}{2854495385411919762116571938898990272765493248} \frac{1}{5708990770823839524233143877797980545530986496} \frac{1}{11417981541647679048466287755595961091061972992} \frac{1}{22835963083295358096932575511191922182123945984} \frac{1}{45671926166590716193865151022383844364247891968} \frac{1}{91343852333181432387730302044767688728495783936} \frac{1}{182687704666362864775460604089535377456991567872} \frac{1}{365375409332725729550921208179070754913983135744} \frac{1}{730750818665451459101842416358141509827966271488} \frac{1}{1461501637330902918203684832716283019655932542976} \frac{1}{2923003274661805836407369665432566039311865085952} \frac{1}{5846006549323611672814739330865132078623730171904} \frac{1}{11692013098647223345629478661730264157247460343808} \frac{1}{23384026197294446691258957323460528314494920687616} \frac{1}{46768052394588893382517914646921056628989841375232} \frac{1}{93536104789177786765035829293842113257979682750464} \frac{1}{187072209578355573530071658587684226515959365500928} \frac{1}{374144419156711147060143317175368453031918731001856} \frac{1}{748288838313422294120286634350736906063837462003712} \frac{1}{1496577676626844588240573268701473812127674924007424} \frac{1}{2993155353253689176481146537402947624255349848014848} \frac{1}{5986310706507378352962293074805895248510699696029696} \frac{1}{11972621413014756705924586149611790497021399392059392} \frac{1}{23945242826029513411849172299223580994042798784118784} \frac{1}{47890485652059026823698344598447161988085597568237568} \frac{1}{95780971304118053647396689196894323976171195136475136} \frac{1}{191561942608236107294793378393788647952342390272950272} \frac{1}{383123885216472214589586756787577295904684780545900544} \frac{1}{766247770432944429179173513575154591809369561091801088} \frac{1}{1532495540865888858358347027150309183618739122183602176} \frac{1}{3064991081731777716716694054300618367237478244367204352} \frac{1}{6129982163463555433433388108601236734474956488734408704} \frac{1}{12259964326927110866866776217202473468949912977468817408} \frac{1}{24519928653854221733733552434404946937899825954937634816} \frac{1}{49039857307708443467467104868809893875799651909875269632} \frac{1}{98079714615416886934934209737619787751599303819750539264} \frac{1}{196159429230833773869868419475239575503198607639501078528} \frac{1}{392318858461667547739736838950479151006397215279002157056} \frac{1}{784637716923335095479473677900958302012794430558004314112} \frac{1}{1569275433846670190958947355801916604025588861116008628224} \frac{1}{3138550867693340381917894711603833208051177722232017256448} \frac{1}{6277101735386680763835789423207666416102355444464034512896} \frac{1}{12554203470773361527671578846415332832204710888928069025792} \frac{1}{25108406941546723055343157692830665664409421777856138051584} \frac{1}{50216813883093446110686315385661331328818843555712276103168} \frac{1}{100433627766186892221372630771322662657637687111424552206336} \frac{1}{200867255532373784442745261542645325315275374222849104412672} \frac{1}{401734511064747568885490523085290650630550748445698208825344} \frac{1}{803469022129495137770981046170581301261101496891396417650688} \frac{1}{1606938044258990275541962092341162602522202993782792835301376} \frac{1}{3213876088517980551083924184682325205044405987565585670602752} \frac{1}{6427752177035961102167848369364650410088811975131171341205504} \frac{1}{12855504354071922204335696738729300820177623950262342682411008} \frac{1}{25711008708143844408671393477458601640355247900524685364822016} \frac{1}{51422017416287688817342786954917203280710495801049370729644032} \frac{1}{102844034832575377634685573909834406561420991602098741459288064} \frac{1}{205688069665150755269371147819668813122841983204197482918576128} \frac{1}{411376139330301510538742295639337626245683966408394965837152256} \frac{1}{822752278660603021077484591278675252491367932816789931674304512} \frac{1}{1645504557321206042154969182557350504982735865633579863348609024} \frac{1}{3291009114642412084309938365114701009965471731267159726697218048} \frac{1}{6582018229284824168619876730229402019930943462534319453394436096} \frac{1}{13164036458569648337239753460458804039861886925068638906788872192} \frac{1}{26328072917139296674479506920917608079723773850137277813577744384} \frac{1}{526561458342785933489590138418352161594475477002745$$

13th. What costs 5 casks butter, each containing 3 stones, 10 lib. 5 oz. Dutch weight at $9\frac{1}{4}$ d. per lib?

Ans. L. 11 16 $10\frac{1}{4}\frac{1}{8}$.

14th. What cost (a) 2 hogsheds tobacco, each weighing (b) 3 cwt. 2 qrs. at (c) 1s. 8d. per (d) lib. deducting (e) 90 lib. for tare off each hhd?

lib d. lib

If $d : c :: b \times a - e \times a : L. 50 \ 6 \ 8$

15th. What cost $37\frac{1}{4}$ ell English at 6s. 7d. per ell?

Ans. L. 12 8 $6\frac{1}{4}$

16th. What cost 5 chests tea, 2 of them containing $78\frac{1}{2}$ lib. and the other 3, $80\frac{1}{4}$ lib. at 4s. $2\frac{1}{4}$ d. per lib?

Ans. L. 83 11 $10\frac{1}{4}\frac{1}{8}$

17th. What cost (a) 3 dozen table spoons, each weighing (b) 1 oz. 19 dwts. at (c) 6s. 2d. per (d) ounce?

If $d : c :: b : L. 21 \ 12 \ 10\frac{1}{2}\frac{1}{8}$

18th. A Draper bought 500 yards broad cloth, for (b) one half of which he paid at the rate of (c) 18s. 6d. per (d) ell English, and for the other (e) half at the rate of (f) 14s. per (g) ell Flemish, how much did he pay in all?

If $d : c :: b : L. 185 \ 0 \ 0$

If $g : f :: e : 233 \ 6 \ 8$

418 6 8 in all.

19th. Bought a) 15 cwt. 3 qrs. for (b) L. 25 10; sold it again at (c) L. 19 10; I demand what I lost per (d) cwt. and (e) per cent?

If $b : b - c :: c : 23\frac{2}{7}$ per cent.

$:: d : \text{per cwt. } L. \ 1 \ 4 \ 9\frac{1}{4}$

20th. Bought (a) 4 logs of timber, containing each (b) 471 solid feet, for (c) L. 50 18 6, I demand what it cost me per (d) foot, and how I am to sell it per foot, to gain (e) L. 25 (f) per cent?

L f f d

If $a \times b : c :: d : 6\frac{1}{4} \frac{1788}{1888} \frac{142}{1788}$ prime cost per foot (g)

If $f : f + e :: g : 8d. \frac{411}{1788}$ selling price per foot.

21st. Bought (a) 128 puncheons of rum for (b) L. 3840 19, upon which I want to gain (c) L. 280 19, I demand what I am to sell it at per (d) gallon?

g f g
If $a : b + c :: d : L. 0 \ 7 \ 8\frac{1}{4}\frac{1}{8}$

22d. If a Merchant purchase (a) 40 hogsheds of sugar, each weighing (b) 9 cwt. 2 qrs 4 lib gros. Tare (c) 20 lib per hhd. what did it come to at (d) $8\frac{1}{2}$ d per (e) lib?

If $e : d :: b \times a - c \times a : L. 1484 \ 13 \ 4$

23d. How many figs for L. 1 13 $4\frac{1}{2}$ at L. 39 14 $4\frac{1}{2}$ per ton? *Ans.* 3 qrs. 10 lib. 2 oz. 11 dr.

24th. If a puncheon of rum cost L. 30 10, what is it per gallon? *Ans.* L. 0 7 $3\frac{1}{4}$

25th. If a bankrupt owes his creditors (a) L. 9452, how much will he pay at (b) 12s. 6d. per (c) pound?

L pr L L

If $c : b :: a : L. 5907 \ 10$

26th. If (a) $\frac{1}{4}$ of a ship cost (b) L. 500 16 8, what will the (c) whole cost?

If $a : b :: c : L. 1335 \ 11 \ 1\frac{1}{4}$

27th. Two men depart from one place, the one goes north and the other south; the one goes (a) 30 miles per (b) day, and the other (c) 40 miles, how far are they distant the (d) 12th day?

If $b : a + c :: d : 840$ miles.

28th. Two vessels sail on the same course, the one sails at the rate of (a) 140 miles per (b) day, the other only (c) 110, I demand how far the one is a-head of the other the (d) 10th day of their departure?

If $b : c - a :: d : 300$ miles.

29th. A traveller would change (a) 50 joannefes, at (b) 36s. per (c) jo, but he must pay (d) 1d. each for change, I demand what he receives in sterling money?

$a \times b \div 20 = L. 90 \ 0 \ 0$

If $c : d :: a : 0 \ 4 \ 2$, or $a \div 12$

89 15 10 sterling.

30th. My staff of (a) 3 feet, 2 inches, gives a shadow of (b) 5 feet, 9 inches, I demand the height of that object which gives a shadow at the same time of the day (c) 300 feet, 9 inches?

If $b : a :: c : 165$ feet, 7 in. $\frac{1}{4}$.

31st. If a tradesman earns (a) 15s. (b) per week, what will he save (c) yearly, when his expences only amount to (d) L. 30?

w f w L

If $b : a :: c : L. 39 - d = L. 9$

32d. Suppose my income to be (a) L. 50 per annum, (b) and I pay for bed, board and washing (c) 12s. (d) per week, what may I spend daily, and not run in debt?

If $d : c :: b : q$ If $b : a - q :: d : L. 0 \ 1 \ 0\frac{1}{4}\frac{1}{8}$.

33d. If a pair of stockings cost 6s. 8d. how many dozen will I get for L. 500?

Ans. 125 dozen.

34th. If 2 horses stand me 3s. per day keeping, what is my expence in keeping 10 horses?

Ans. L. 0 15 0

35th. Bought (a) 16 yards cloth for (b) L. 8 5 3 what must be given for (c) 12 pieces, each (d) $12\frac{1}{2}$ yards?

qrs d pie qrs

If $a : b :: c \times d : L. 77 \ 9 \ 2\frac{1}{4}\frac{1}{8}$.

36th. If (a) 2 oz. of gold be worth (b) L. 9 5 $8\frac{1}{2}$, what will (c) 3 grains be worth?

gr farth gr

If $a : b :: c : L. 0 \ 0 \ 6\frac{1}{4}\frac{81}{880}$.

37th. If 12 lib. figs cost 3s. 4d. what will 3 cwt. 3 qrs. cost?

Ans. L. 5 16 8

38th. A Merchant at London buys (a) 68 tons of French wine for (b) L. 470, the freight thereof from France to London cost (c) L. 234, for loading and unloading (d) L. 19, for custom (e) L. 24, the charge of the cellar (f) L. 12, and would gain (g) L. 260 by the bargain; a Gentleman comes

Rule of Three

A bankrupt owes his creditors £17003..6..8, how much can he pay them at $13\frac{1}{4}$ p^r pound.

$$\begin{array}{r}
 \text{If } \text{£ } 1 : 13..4 :: 17003 \text{ } 6..8 : \\
 \underline{\quad 3 \quad} \\
 \underline{\quad 3 \quad} \\
 \quad 51010 \\
 \quad \quad 2 \\
 \quad 3 \overline{) 102020} \\
 \quad 3 \overline{) 34006..13..4} \\
 \text{£ } \underline{\underline{11335..11..1\frac{1}{3} \text{ Ans.}}}
 \end{array}$$

What is the interest of £1897..18..9 at 5 p^r Cent p^r Annum.

$$\begin{array}{r}
 \text{If } \text{£ } 100 : 5 :: 1897..18..9 : \\
 100 \overline{) 9489..13..9} \\
 \quad 94..17..11\frac{1}{2} \text{ Ans.}
 \end{array}$$

[Faint, illegible handwriting, possibly bleed-through from the reverse side of the page]

and demands the price of (h) 36 tons of said wine, what is his answer?

Tons L L L L L L Tons

If $a : b + c + d + e + f + g :: h : L.539 \ 9 \ 4\frac{1}{2}$

39th, If (a) an ounce of silver be worth (b) 5s. 4d. what is the price of a bowl weighing (c) 8 lib. 4 oz. 12 dwts?

dwts d dwts

If $a : b :: c : L.26 \ 16 \ 6\frac{1}{2}$

40th, A Draper bought (a) 19 packs of cloth, each containing (b) 6 parcels, each parcel (c) 11 pieces, each piece (d) 27 yards, and gave after the rate of (e) L.4 13 6 for (f) 6 yards. I desire to know what the whole cost him?

yards d pa par pie yards

If $f : e :: a \times b \times c \times d : L.26381 \ 0 \ 6$

41st, Bought (a) 20 pieces of cloth, each (b) 24 ells, for (c) L.300, what is that per (d) ell?

pie ells L ells

If $a \times b : c :: d : L.0 \ 12 \ 6$

42d, If a clerk's salary be (a) L.100 a (b) year, what is that per (c) week?

If $b : a :: c : L.1 \ 18 \ 5\frac{1}{2}$

43d, Suppose a butcher purchase (a) 16 oxen, weighing altogether (b) 3 tons, 5 cwt. what was the weight (c) of each?

ox cwt ox

If $a : b :: c : 4\frac{1}{2}$ of a cwt.

44th, How many yards may be bought for (a) L.60, when (b) $5\frac{1}{2}$ yards cost (c) L.4 8?

s qrs s

If $c : b :: a : 75$ yards.

45th, Bought (a) 19 cwt. 2 qrs. 18 lbs. of iron at (b) $3\frac{1}{4}$ d. per (c) lib. what does it come to?

lib farth lib

If $c : b :: a : L.34 \ 8 \ 1\frac{1}{2}$

46th, If coffee is sold for (a) $1\frac{1}{2}$ d. per (b) ounce, what must be given for (c) 3 cwt?

oz farth oz

If $b : a :: c : L.33 \ 12$

47th, If I buy (a) 1000 ells of Flemish linen for (b) L.140, what may I sell it at per (c) ell to gain (d) L.16 by the whole?

ells L L ells

If $a : b + d :: c : L.0 \ 3 \ 1\frac{1}{2} \ 7\frac{60}{1000}$

Questions which are to prove themselves for Answers.

EXAMPLES.

48th, If 3 yards cost 27s. what cost 84 yards?

49th, If 12 yards cost L.18 16, what cost 36 yards?

50th, If 3 cwt. cost L.5 16, what cost 3 tons, 12 cwt. 3 qrs?

51st, If 18 cwt. cost L.60, what cost 3 cwt?

52d, If 3 hogheads of sugar cost L.40 16, what cost 20 hhds?

53d, If 76 yards cost L.20, what cost 6 yards?

54th, If 1 yard cost 7s. what cost 20 yards?

55th, If 4 lbs. cost 4s. what cost 27 pounds?

56th, If 3 oz. of silver cost 16s. what cost 38 ounces?

57th, If 1 gallon cost 4s. what cost 34 gallons?

58th, If 4 gallons cost 15s. what cost 38 gallons?

59th, If 1 qr. cost 2d. what cost 18 qrs.

60th, If 100 yards cost L.5 8, what cost 36 yards?

61st, If 16 gallons of beer cost 4s. 8d. what cost 60 gallons?

62d, If $2\frac{1}{2}$ oz. of silver cost 15s. 6d. what cost 3 lib. 16 ounces?

63d, If 3 grains of gold cost 6s. 8d. what cost 2 oz. 5 dwts. 20 grains?

64th, If 1 dwt. of silver cost 3d. what cost 48 dwts.

65th, If 8 gallons of beer cost 1s. 10d. what cost 16 gallons?

66th, If 20 lbs. tobacco cost L.4 18, what cost 90 lbs?

67th, If 11 lib. of lead cost 12s. $2\frac{1}{2}$ d. what cost 1 cwt. 2 qrs. 18 lbs?

Questions whose terms are to be abridged.

RULE.

Take any figure that will divide the first term, and either the second or third, without a remainder; and if the quotients are under twelve, or such numbers that component parts can be taken of them, proceed as in Compound Multiplication and Division.

EXAMPLES.

68th, The shorter end of the beam of a balance is (a) 54 inches, and the longer end (b) 72, how much suspended on the longer end will equiponderate (c) 40 lib. on the shorter?

If $a : c :: b : 53\frac{1}{2}$ Ans.

69th, If 60 horses plow 24 acres, how many will 80 plow in the same time? Ans. 32 acres.

70th, If 24 yards of cloth cost 88s. what will 60 yards cost? Ans. L.11 0 0

71st, If 732 men consume 150 barrels provisions, how much will 1000 men consume in the same time? Ans. $204\frac{1}{11}$ barrels.

72d, If I lend my friend (a) L.200 for (b) 6 months, how long ought he to lend me (c) L.560 to equal my kindness?

L months L

If $c : b :: a : 2\frac{1}{2}$ months.

73d, If a garrison of (a) 500 men have provisions for (b) 4 months, how many men will the same provisions serve (c) 8 months?

mo men mo

If $c : a :: b : 250$ men.

74th, If when the wheat is at (a) 4s. 4d. the (b) 6d.

loaf weighs (c) 2 lib. 12 oz. what is the price of the same quantity when it weighs (d) 2 lib. 10 oz. 13 dwts?

$$\text{dwts } d \quad \text{dwts } c$$

$$\text{If } d : a :: c : L. 0 \ 5 \ 0 \frac{1}{4} \frac{1}{2}$$

75th, The shadow of a cloud was observed to move at the rate of (a) 40 yards in (b) 10 seconds, what was the (c) hourly motion of the wind?

$$\text{sec } yds \quad \text{sec } c$$

$$\text{If } b : a :: c : 14400 \text{ yards.}$$

76th, Supposing found to travel at the rate of 1142 feet in a second of time, I demand the distance between yonder ship and where I stand, when I counted 40 seconds between the flash of her signal gun and the report?

$$\text{sec } feet \quad \text{sec } c$$

$$\text{If } 1 : 1142 :: 40 : 45680 \text{ feet.}$$

77th, How far distant am I from a thunderbolt when I can count 12 seconds between the flash and the explosion?

$$\text{sec. } feet \quad \text{sec } c$$

$$\text{If } 1 : 1142 :: 12 : 13704 \text{ feet.}$$

78th, If a L. 100 in twelve months gain a sum of interest, what principal will gain the sum of interest in 8 months? *Ans.* L. 150.

79th, If 40 poles in length, and 4 in breadth make an acre, what must be the length to make an acre when the breadth is 15 poles? *Ans.* 10 poles, 3 yards, 2 feet.

80th, If a courier makes a journey in 24 days when the day is 12 hours long, in how many days may he make out the same journey when the day is 16 hours? *Ans.* 18 days.

81st, How many pieces of money of 22s. value are equal to 256 pieces of 14s. each? *Ans.* 162 20 rem.

82d, How much plush is sufficient for a cloak which has in it 5 yards of 6 qrs. wide of stuff for the lining, the plush being but 3 qrs. wide? *Ans.* 10 yards.

CRITERION.

$$L. 869 \ 16 \ 8 \frac{1}{2} + L. 367 \ 16 \ 9 \frac{1}{2} + L. 1000 \ 16 \ 9 + L. 5$$

$$13 \ 6 \frac{1}{2} + L. 0 \ 10 \ 11 \frac{1}{2} + L. 0 \ 3 \ 3 \frac{1}{2} + L. 0 \ 0 \ 0 \frac{1}{2} =$$

$$\text{cwt qrs lib } L.$$

$$L. 1678 \ 10 \ 3 \frac{1}{2} = r \times 8 \frac{1}{2} = p \div 9 \frac{1}{2} = q : 33 \ 3 \ 14 :: 56 :$$

$$\text{lib oz dr.}$$

$$416 \ 1 \ 9 \ 1 \frac{7}{8} \ 9 \ 0 \ 5 \ 4$$

Queries to be answered in writing.

1st, How many terms are there in the Rule of Three?

2d, Are your first and last terms to be of the same kind and denomination in Direct Proportion.

3d, Are your middle term and your answer to be of the same kind in Direct Proportion.

4th, If your answer is to be greater than your middle term, ought your last term to be greater than your first?

* This rule being so generally useful, particularly in mercantile computations, the scholar who points at that way of life ought to make himself thoroughly master of it by varying and proving the questions in all the different ways his genius and knowledge can suggest, in order to find the surest, speediest, and easiest methods of coming at the answer. And as the operations are little different from Compound Multiplication and Division, except in finding the aliquot parts or divisors, (which requires a good deal of art, and may be done so as to shorten the process considerably) it will not be difficult to make him understand Practice, if he previously know these rules well.

5th, If your answer is to be less than your middle term, ought your last term to be less than your first?

6th, If your first term consisted of pounds, and your last shillings and pence and farthings, what would you do?

7th, If your last term was cwt. and your first ounces, what would you do?

8th, If your first term was integers and fractions, and your last only integers, what would you do?

9th, If your middle term was reduced to farthings, what would your answer come out, and how would you manage it?

10th, In proving questions with remainders how would you treat them?

11th, Do you know what is meant by a reciprocal state of the Rule of Three?

12th, Do you know the distinction betwixt Direct and Inverse Proportion?

PRACTICE*

Is a short and easy way of performing the Rule of Three Direct, when the first term is no more than one, by taking aliquot parts of the price for divisors, by which the given quantity is divided, and then the quotients are added for the answer.

N. B. The first remainder is always of the same kind with the price of which you take the part.—As for example, if you say 6s. 8d. = $\frac{1}{2}$ of a pound, then the first remainder arising from the division by 3, is pounds,—then shillings—then pence—then farthings—then fractions.

TABLE OF ALIQUOT PARTS.

s.	d.	d.
10	0 = $\frac{1}{2}$ L.	6 = $\frac{1}{10}$ L. or $\frac{1}{2}$ of a shilling.
6	8 = $\frac{1}{3}$	5 = $\frac{1}{12}$
5	0 = $\frac{1}{4}$	4 = $\frac{1}{20}$ or $\frac{1}{4}$
4	0 = $\frac{1}{5}$	3 $\frac{1}{4}$ = $\frac{1}{15}$
3	4 = $\frac{1}{6}$	3 = $\frac{1}{10}$ or $\frac{1}{3}$
2	6 = $\frac{1}{8}$	2 $\frac{1}{2}$ = $\frac{1}{8}$
1	8 = $\frac{1}{12}$	2 = $\frac{1}{10}$ or $\frac{1}{5}$
1	4 = $\frac{1}{15}$	1 $\frac{1}{2}$ = $\frac{1}{10}$ or $\frac{1}{5}$
1	3 = $\frac{1}{16}$	1 $\frac{1}{4}$ = $\frac{1}{16}$
1	0 = $\frac{1}{20}$	1 = $\frac{1}{20}$ or $\frac{1}{10}$
10	0 = $\frac{1}{10}$	$\frac{1}{2}$ = $\frac{1}{10}$ or $\frac{1}{5}$
8	0 = $\frac{1}{10}$	$\frac{1}{4}$ = $\frac{1}{10}$ or $\frac{1}{5}$
7 $\frac{1}{2}$	0 = $\frac{1}{10}$	$\frac{1}{8}$ = $\frac{1}{10}$ or $\frac{1}{5}$

Practice

325 $\frac{1}{4}$ or 325.25 Ct at £2.0.2 $\frac{1}{4}$ 640 $\frac{7}{8}$ or 640.875 at 11/7 $\frac{3}{4}$

2 = $\frac{1}{120}$
 $\frac{1}{4} = \frac{1}{8}$

650.50
 2.71041
 3388

£653.54921 = £653.10.11 $\frac{3}{4}$

1 = $\frac{1}{20}$
 6 = $\frac{1}{2}$
 $\frac{1}{4} = \frac{1}{4}$
 $\frac{1}{2} = \frac{1}{2}$

3204375
 320437
 160218
 40054
 6675

£373.176

What cost 16 Tun 3 hhd 53 gal at £28.7.2

6/8 $\frac{1}{3}$
 6 $\frac{1}{40}$

16.960317
 28
 135.682536
 339.20634
 5.6534
 424

£480.9663

5 Ct per lib

96.18.2.24 at £6.15.

96.93571

581.61426

72.70178

£654.31604 £654.63 $\frac{3}{4}$

What cost 40 Ct 3 qrs 24 lib at £18.4.6 p Ct.

1 £
 4 = $\frac{1}{5}$
 6 = $\frac{1}{8}$

40.9642857
 18

737.3571426

8.1928571

1.0241071

£746.5741068

2 = $\frac{1}{2}$

91.2.6
 8

729.

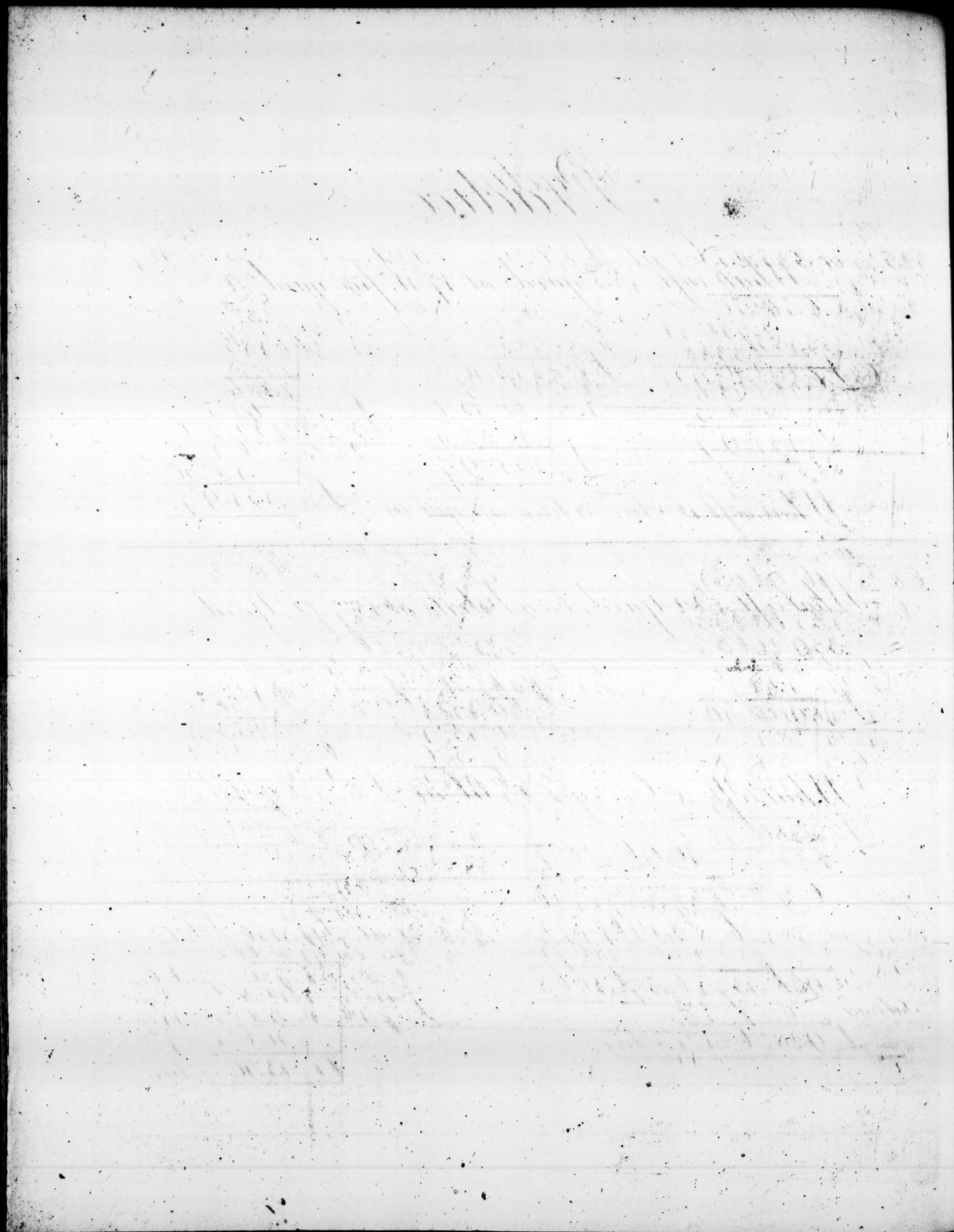
9.2.3

4.11.1 $\frac{1}{2}$

2.12.0 $\frac{3}{4}$

1.6.0 $\frac{1}{4}$

£746.11.5 $\frac{1}{2}$



Practice

What cost 485 yards at $17\frac{1}{16}$ per yard?

$$\begin{array}{r}
 \text{1st} \\
 \text{10} = \frac{1}{2} \quad 485 \\
 \text{6/8} = \frac{1}{3} \quad 242.10 \\
 \text{1/3} = \frac{1}{8} \quad 161.13.4 \\
 \quad \quad 30.6.3 \\
 \hline
 \text{£} 434.9.7
 \end{array}$$

$$\begin{array}{r}
 \text{2nd} \\
 \text{10} = \frac{1}{2} \quad 485 \\
 \text{5} = \frac{1}{2} \quad 242.10 \\
 \text{2/6} = \frac{1}{2} \quad 121.5 \\
 \text{5} = \frac{1}{6} \quad 60.12.6 \\
 \quad \quad 10.2.1 \\
 \hline
 \text{£} 434.9.7
 \end{array}$$

$$\begin{array}{r}
 \text{3rd} \\
 \text{1} = \frac{1}{20} \quad 485 \\
 \quad \quad 8 \\
 \hline
 388 \\
 \text{6} = \frac{1}{2} \quad 24.5 \\
 \text{3} = \frac{1}{2} \quad 12.2.6 \\
 \text{2} = \frac{1}{3} \quad 6.1.3 \\
 \quad \quad 4.0.10 \\
 \hline
 \text{£} 434.9.7
 \end{array}$$

What cost 422 yards broad cloth at $13\frac{1}{7}$ p. Yard

$$\begin{array}{r}
 \text{1st} \\
 \text{5} = \frac{1}{4} \quad 422 \\
 \text{4} = \frac{1}{5} \quad 105.10 \\
 \text{4} = \frac{1}{5} \quad 84.8 \\
 \text{6} = \frac{1}{8} \quad 84.8 \\
 \text{1} = \frac{1}{6} \quad 10.11 \\
 \quad \quad 1.15.2 \\
 \hline
 \text{£} 286.12.2
 \end{array}$$

$$\begin{array}{r}
 \text{2nd} \\
 \text{13/42} \quad 422 \\
 \quad \quad 140.13.4 \\
 \text{3} = \frac{1}{80} \quad 140.13.4 \\
 \quad \quad 5.5.6 \\
 \hline
 \text{£} 286.12.2
 \end{array}$$

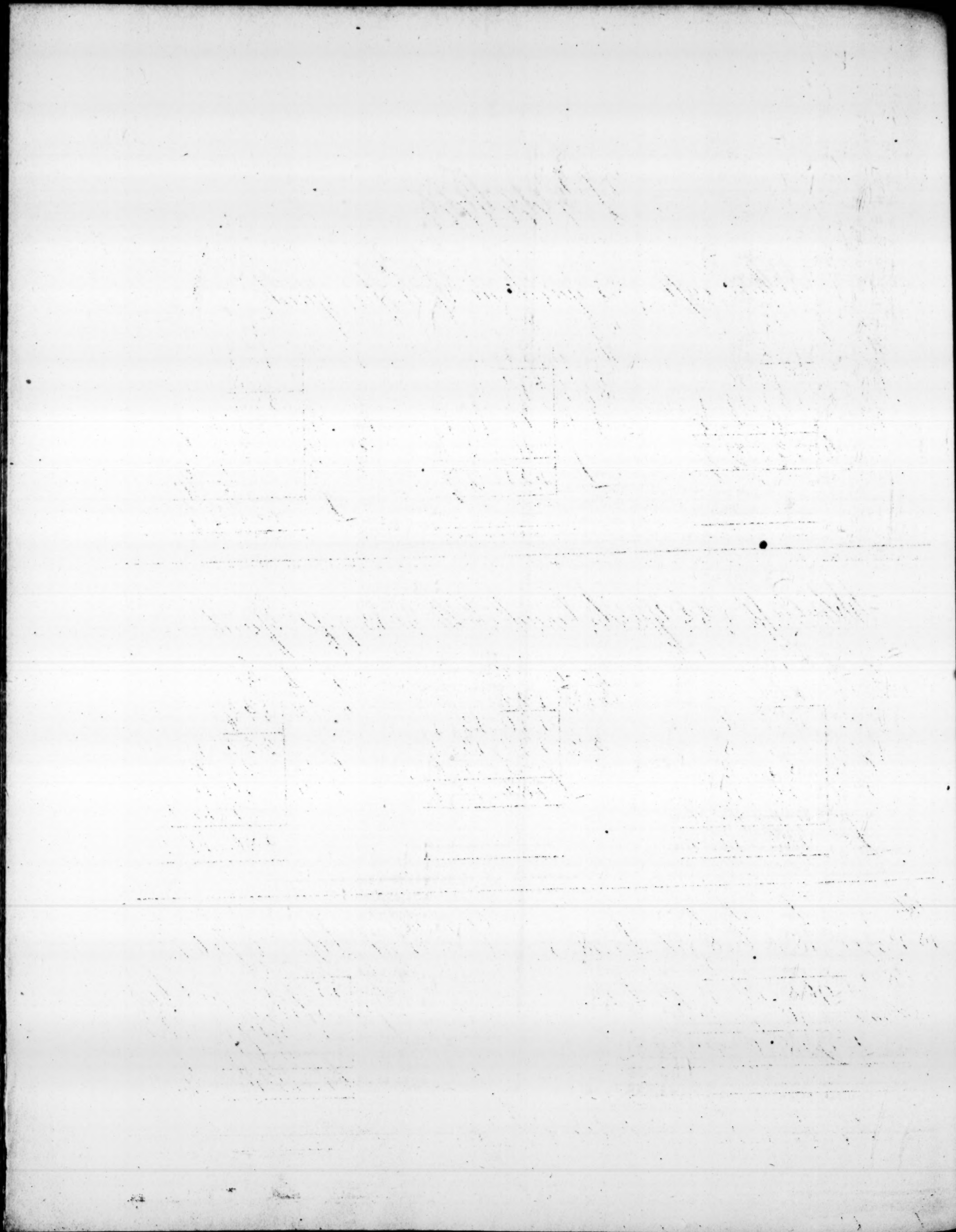
$$\begin{array}{r}
 \text{3rd} \\
 \text{1} = \frac{1}{20} \quad 422 \\
 \quad \quad 6 \\
 \hline
 253.4 \\
 \text{6} = \frac{1}{2} \quad 21.2 \\
 \text{1} = \frac{1}{6} \quad 10.11 \\
 \quad \quad 1.15.2 \\
 \hline
 286.12.2
 \end{array}$$

Yds $484\frac{1}{3}$ or $484.6.8$ at $\text{£} 18.4$

$$\begin{array}{r}
 \text{1/8} = \frac{1}{12} \quad 968.13.4 \text{ for } \text{£} 2 \\
 \text{Subtract} \quad 40.7.2\frac{1}{2} \\
 \hline
 \text{£} 928.6.1\frac{1}{2} \text{ Ans.}
 \end{array}$$

Ct qrs lib $6.2.21$ at $\text{£} 9.4.6$ p Ct.

$$\begin{array}{r}
 \text{2} = \frac{1}{2} \quad 55.7.0 \text{ for 6 Ct.} \\
 \text{11} = \frac{1}{4} \quad 4.12.3 \\
 \text{7} = \frac{1}{2} \quad 1.3.0\frac{3}{4} \\
 \quad \quad 11.6\frac{1}{4} \\
 \hline
 61.13.10 \text{ Ans.}
 \end{array}$$



Parts of a Cant.

grs	lib
2	0 = $\frac{1}{2}$
1	0 = $\frac{1}{4}$
0	16 = $\frac{1}{2}$
0	14 = $\frac{1}{4}$ or $\frac{1}{2}$ qr.
0	8 = $\frac{1}{4}$
0	7 = $\frac{1}{8}$ or $\frac{1}{4}$
0	4 = $\frac{1}{8}$ or $\frac{1}{4}$
0	3 = $\frac{1}{8}$ or $\frac{1}{4}$

Table of Discounts per Cent.

L	s	d
2½ per cent.	0	6 p. pound
5	1	0
7½	1	6
10	2	0
12½	2	6
15	3	0
17½	3	6
20	4	0
22½	4	6
25	5	0
30	6	0
35	7	0

CASE 1.

When the price is farthings and pence, either take the aliquot parts of a penny, a shilling, or a pound, and the sum of the quotients will be the answer; or bring the price to farthings for a multiplier, and divide by 4, 12, and 20.

EXAMPLES.

1	63218 at $\frac{1}{4}$ d.	=	L. 65	17	0½
2	4592 at $\frac{1}{4}$ d.		9	11	4
3	29764 at 1d.		124	0	4
4	764280 at 1½d.		4776	15	0
5	39748 at 2d.		331	4	8
6	29480 at 2½d.		307	1	8
7	1764 at 3d.		22	1	0
8	4567 at 3½d.		61	16	10½
9	48760 at 4d.		812	13	4
10	12948 at 4½d.		256	5	3
11	7181 at 5d.		149	12	1
12	8121 at 5½d.		177	12	11½
13	2000 at 6d.		50	0	0
14	945 at 6½d.		26	11	6½
15	762 at 7d.		22	4	6
16	548 at 7½d.		16	11	1
17	396 at 8d.		13	4	0
18	999 at 8½d.		35	7	7½
19	696 at 8¾d.		25	7	6
20	595 at 9d.		22	6	3
21	847 at 9½d.		32	12	10½
22	448 at 9¾d.		18	4	0
23	2080 at 10d.		86	13	4
24	1456 at 10½d.		63	14	0
25	897 at 11d.		43	18	3½

CASE 2.

Take parts for the price that is above a shilling, and add the quotients to the given quantity for the answer.

EXAMPLES.

1	3872 at 12d.	=	L. 193	12	0
2	1763 at 12½d.		89	19	8½
3	7846 at 12½d.		408	12	11
4	6745 at 13½d.		386	8	7½
5	4678 at 14d.		272	17	8
6	695 at 14½d.		41	19	9½
7	2087 at 15d.		130	8	9
8	3498 at 15½d.		222	5	4½
9	6100 at 16d.		406	13	4
10	5082 at 16½d.		349	7	9
11	6782 at 16½d.		473	6	6½
12	5923 at 17d.		419	10	11
13	1872 at 17½d.		136	10	0
14	9849 at 18d.		738	13	6
15	2178 at 19½d.		176	19	3
16	1238 at 20d.		103	3	4
17	2745 at 21½d.		245	18	1½
18	923 at 22½d.		87	9	10½
19	789 at 23d.		75	12	3

CASE 3.

Multiply the given quantity by half of the price, and double the right hand figure of the product for shillings, and add the carriage as in Multiplication.

EXAMPLES.

1	128 at 2s.	=	L. 12	16	0
2	725 at 4s.		145	0	0
3	928 at 6s.		278	8	0
4	323 at 8s.		129	4	0
5	937 at 10s.		468	10	0
6	849 at 12s.		509	8	0
7	632 at 14s.		442	8	0
8	573 at 16s.		458	8	0
9	792 at 18s.		712	16	0

CASE 4.

The aliquot parts being found, proceed to work for the answer as in Compound Division.

EXAMPLES.

1	4820 at 3s. 4d.	=	L. 803	6	8
2	5398 at 1s. 8d.		449	16	8
3	2932 at 6s. 8d.		977	6	8

4	3289 at 2s.	=	L.328	18	0
5	8251 at 4s.		3650	4	0
6	9164 at 5s.		2291	0	0
7	9329 at 4s. 6d.		2099	0	6
8	6984 at 9s. 8d.		3375	12	0
9	8927 at 2s. 6d.		1115	17	6
10	5238 at 3s. 11½d.		1036	13	9
11	6321 at 5s. 9½d.		1830	9	1½
12	7215 at 2s. 10d.		1022	2	6
13	8392 at 7s. 6d.		3147	0	0
14	7639 at 10s. 8d.		4074	2	8
15	2736 at 11s. 4d.		1550	8	0
16	6973 at 9s. 9½d.		3413	17	3½
17	3769 at 15s. 11½d.		3011	5	5½
18	4829 at 12s. 10d.		3098	12	2
19	9248 at 13s. 5½d.		6223	2	8
20	4298 at 11s. 7½d.		2502	13	9½

CASE 5.

Bring the fractions to value, let the quantity stand for pounds, multiply by the pounds in the price, and take parts for the rest.

EXAMPLES.

1	328½* at 3s. 6d.	=	L.57	8	10½
2	828½ at 4s. 9d.		196	15	4½
3	296½ at 15s. 6d.		229	19	7½
4	157½ at 12s.		94	7	0
5	142½ at 2s. 8d.		18	19	8
6	742½ at L.3 7 8½		2513	19	0½
7	651½ at L.2 10 6		1645	7	0½
8	165½ at L.9 19 9½		1650	19	0
9	240½ at L.12 8 5½		2986	14	4½ 8
10	784 at 7s 2½d.†		282	16	9½
11	493 at 11s. 9½d.		289	16	10½ 8
12	5174 at 4s. 5½d.		1151	11	5½ 8

CASE 6.

Multiply the price by the highest denomination in the quantity, and take aliquot parts for the rest; but this Case, as well as many of the rest, is greatly facilitated by decimals.

EXAMPLES.

<i>Cwt qrs lbs</i>					
8	2	16 at L.5 12 6	=	L.48	12 3½
15	3	18 at L.4 11 9		72	19 9½

* To bring ½ of a pound to value, multiply the 1, or upper term by 20, and divide by 4, or the under term, which will quote 5 shillings, and if there had been any remainder it should have been multiplied by 12 for pence, &c.; but to turn the fraction to a decimal is the simplest way.

† A troublesome fraction in the price may be avoided by multiplying the whole price by the denominator; divide for the product as if it were the price given, but divide the answer found by the same number or denominator by which you multiplied, for the true answer.

<i>Cwt qrs lbs</i>					
7	1	7 at L.36 18 5½	=	L.270	0 1½
17	3	19 at L.2 2 6		38	1 6½
96	3	27 at L.56 19 2½		5524	10 11½
<i>Libs oz dwts</i>					
8	7	15 at L.3 4 7½		27	18 8½
<i>Libs oz dwts gr</i>					
2	1	4 18 at L.3 12 6		7	12 5½
<i>Acres rods poles</i>					
12	3	20 at 18s. 11d.		12	3 6½
48	1	12 at L.1 19 3		94	16 8½
<i>Feet inches</i>					
228	8	at 6s. 10½d.		78	16 10
16	11	at L.1 10 6		25	15 11½
<i>Cwt qrs lbs</i>					
120	2	18 at L.5 2 10		620	7 11½

CASE 7.

When the quantity is 240, (the number of pence in a pound,) every penny in the price will be pounds in the answer, three farthings will be fifteen shillings, a halfpenny ten shillings, and a farthing five shillings.

EXAMPLES.

240 at 1s. 9½d.	=	L.21	5	0
240 at 1s. 3½d.		15	15	0
240 at 3s. 11½d.		47	10	0
240 at 11s. 3½d.		135	15	0
240½ at 17s. 6d.		210	8	9
240 at 2s. 3½d.		27	15	0
240 at 4s. 9½d.		57	5	0

CASE 8.

When the quantity is not less than 228, nor more than 252, first find the value of 240 according to Case 7th, then multiply the price of 1 by the number above or under 240, and add or subtract this product from the value of 240 as the question may require, and the sum or remainder will be the answer.

EXAMPLES.

241 at 18s. 4d.	=	L.220	18	4
245 at 4s. 5½d.		54	7	2½
237 at 1s. 5d.		16	15	9
249 at 4s. 11½d.		61	9	5½

$233\frac{1}{2}$ at 3s. 1d. = L. 35 19 11 $\frac{1}{2}$
 244 at 11 $\frac{1}{2}$ d. = 11 18 11
 243 at 7s. 2 $\frac{1}{2}$ d. = 87 16 8 $\frac{1}{2}$
 230 at 11s. 11d. = 137 0 10

CASE 9.

At any rate per lib. to find the value of 1 cwt. or 112 lbs. for every penny in the rate reckon 9s. 4d., and for every farthing $\frac{1}{4}$ of 9s. 4d. or 2s. 4d.

EXAMPLES.

What cost 112 lbs. at 1s. 8d. per lib?

$$9 \ 4 \times 10 \times 2 = L. 9 \ 6 \ 8$$

$$112 \text{ at } 8\frac{1}{2}\text{d.} = L. 4 \ 1 \ 8$$

$$56 \text{ at } 2\text{s. } 10\text{d.} = 7 \ 18 \ 8$$

$$336 \text{ at } 3\text{s. } 11\text{d.} = 65 \ 16 \ 0$$

CASE 10*.

When the price is near to any easier number for working with than that given, find the value at that easy price, and take parts for the difference between the given price and it; then subtract the amount of the difference from the amount of the easy number. As for example, if the given price be 11 $\frac{1}{2}$ d., take parts for the $\frac{1}{2}$ d. and subtract the quotient from the quantity, or the amount at 1s.

EXAMPLES.

$$(a) \ 249 \text{ at } 11\frac{1}{2}\text{d.} \quad a \ S. - \frac{1}{4} = L. 11 \ 18 \ 7\frac{1}{2}$$

$$(a) \ 575 \text{ at } 9\frac{1}{2}\text{d.} \quad a \ S. - \frac{1}{8} \ \& \ \frac{1}{8} = 23 \ 7 \ 2\frac{1}{2}$$

$$(a) \ 392 \text{ at } 19\text{s. } 6\text{d.} \quad a \ L. - \frac{1}{10} = 382 \ 4 \ 0$$

PROMISCUOUS EXERCISES.

328 yards at 2s. 6d. per yard, L. 41 0 0
 5164 yards at 11s. 8 $\frac{1}{2}$ d. 3023 1 10
 8635 yards at 3s. 10d. 1655 0 10
 3918 yards at 12s. 6d. 2448 15 0
 648 ells at 4s. 7d. per ell, 148 10 0
 4873 $\frac{1}{2}$ bushels at 7s. 6d. per bush. 1827 9 4 $\frac{1}{2}$
 3231 $\frac{1}{2}$ yards at 9s. 4 $\frac{1}{2}$ d. per yard, 1518 2 7 $\frac{1}{2}$
Cwt qrs lib
 57 3 17 at L. 6 14 7 $\frac{1}{2}$ d. per cwt. 389 15 0 $\frac{1}{2}$
Cwt qrs lib
 98 1 22 at 7s. 2d. 35 5 6 $\frac{1}{2}$
 1171 $\frac{8}{9}$ at L. 1 18 4 2246 2 4 $\frac{1}{2}$
 471 $\frac{5}{8}$ yards at 18s. 11 $\frac{1}{2}$ d. per yard, 447 5 2
Lbs oz dwts
 3 11 10 at L. 4 12 6 per lib. 18 6 1 $\frac{1}{2}$
Cwt qrs lib
 144 2 21 at L. 3 17 6 per cwt. 560 13 3 $\frac{1}{2}$
Tons cwt qrs
 73 17 2 at L. 9 12 10 per ton, 712 5 6 $\frac{1}{2}$

Tons cwt qrs lib
 8 15 3 27 at L. 14 0 0 per ton, 123 3 10 $\frac{1}{2}$
 600 yards at 7 $\frac{1}{2}$ d. per yard 19 13 9

Acres roods poles
 127 3 15 at L. 26 11 2 $\frac{1}{2}$ per ac. 3395 11 7 $\frac{1}{2}$

Cwt qrs lib
 63 2 27 at L. 6 19 2 per cwt. 443 10 7 $\frac{1}{2}$
 228 $\frac{1}{2}$ yards at 12s. 11d. per yard, 147 14 8 $\frac{1}{2}$
 1202 $\frac{1}{2}$ yards at 15s. 8 $\frac{1}{4}$ of $\frac{1}{2}$ d. per yard, 943 0 3 $\frac{1}{2}$

CRITERION.

L. 128 16 8 $\frac{1}{2}$ + L. 5998 3 2 $\frac{1}{2}$ + L. 9 5 8 $\frac{1}{2}$ + L. 5876
 16 8 $\frac{1}{2}$ + L. 8695 16 8 $\frac{1}{2}$ + L. 865 16 9 $\frac{1}{2}$ + L. 5608 16 3 $\frac{1}{2}$
 + L. 1 1 0 $\frac{1}{2}$ + L. 3876 5 + L. 3 0 0 $\frac{1}{2}$ = L. 31000 13
Cwt qrs lib yds L
 $3\frac{1}{2} = r \times 1568 \ 3 \ 14 = p \div 64\frac{7}{8} : 1683 :: 1856\frac{1}{2} : = q$
 at L. 3 2 8 $\frac{1}{2}$ = L. 642 7 8 $\frac{1}{2}$

BILLS OF PARCELS.†

Glasgow, 24th March, 1797.

Messrs. M'Lachlan and Co.

Bought of Frazer and Dunlop

14 pfs. Ofnaburghs, qt. 1257 yards at 8 $\frac{1}{2}$ d.
 per yard, L. 45 16 6 $\frac{1}{2}$
 207 yards Irish Linen at 1s. 10 $\frac{1}{2}$ d. per yard, 19 3 9 $\frac{1}{2}$
 306 yards fine Holland, at 3s. 4 $\frac{1}{2}$ d. 51 9 6 $\frac{1}{2}$
 421 yards Sheeting, at 1s. 3d. 26 6 3
 1023 yards Cheques, at 10 $\frac{1}{2}$ d. 45 16 5 $\frac{1}{2}$
 2073 yards figured Cloth, at 4s. 8 $\frac{1}{2}$ d. 448 0 4 $\frac{1}{2}$
 218 yards striped Linen, at 3s. 4 $\frac{1}{2}$ d. 37 2 6 $\frac{1}{2}$
 1343 yards coarse Holland, at 1s. 2 $\frac{1}{2}$ d. 81 12 1 $\frac{1}{2}$
 L. 795 7 8

Discount,

By Cash,

FRASER and DUNLOP.

Glasgow, 14th April, 1797.

Mr. William Allen,

Bought of John Fleming,

5 yards of Silk, at 13s. 4d. per yard, L.
 9 yards of Satin, at 13s. 4d.
 14 yards of Brocade, at 19s. 2 $\frac{1}{2}$ d.
 13 yards of Sarcenet, at 4s. 8 $\frac{1}{2}$
 4 yards of flowered Silk, at 15s. 3 $\frac{1}{2}$ d.
 14 yards of Velvet, at 24s. 8d.

L. 46 3 2 $\frac{1}{2}$

By Cash,

JOHN FLEMING.

Paisley, 13th May, 1797.

Mr. Alexander Henry,

Bought of John Hofier,

4 pair of white Worsted Stockings, at 3s. 8d.
 per pair, L.

* This rule, if much studied, will be found a very pleasing way of abridging, and a ready method of checking operations in other cases of Practice.

† As there is a great deal of real business in extending the sums of these bills, it gives the scholar an opportunity of exercis-

7 pair black Do. at 3s. 4½d.
 9 pair Thread Do. at 3s. 9½d.
 4 pair Silk Do. at 14s. 10½d.
 13 pair Cotton Do. at 4s. 5½d.
 18 yards fine Flannel, at 2s. 4d.
 9 yards coarse Do. at 1s. 3½d.

L.12 4 7

Discount at 5 per cent.

By Cash,

L.11 12 5
 JOHN HOSIER.

Greenock, 5th June, 1797.

Mr. Simon Brown,

Bought of William Willie,

14 lib. Raw Sugar, at 11d. per lib.
 28 lib. Single Refined do. at 1s. 3d.
 5 lib. Tea, at 5s. 2d.
 17 lib. Barley, at 1½d.
 12 lib. Raisins, at 10½d.
 14 lib. Green Tea, at 17s. 6d.
 19 lib. Coffee, at 10½d.
 29 lib. Apples, at 3½d.
 3 cwt. Ginger, at L.4 15s. per cwt.
 2 cwt. Allum, at 18s. 3d.

L.34 17 2

Discount at 5 per cent.

By Cash,

L.33 2 3
 WILLIAM WILLIE.

Aberdeen, 1st June, 1797.

Mr. Robert Dixon,

Bought of James Rodger,

43 yards of Cambric, at 5s. 8½d. per yard, L.
 13 yards of Lawn, at 8s. 4d.
 15 yards of French do. at 15s. 4d.
 24½ yards Linen, at 2s. 3d.
 17½ yards Holland, at 2s. 4½d.
 12 yards striped Linen, at 4s. 3d.
 13 yards flowered Cloth, at 3s. 4½d.

L.38 12 5½

Discount, at 7½ per cent.

By Cash,

L.35 14 7
 JAMES RODGER.

Perth, 2d May, 1797.

Mr. Dugald M'Beath,

Bought of James Cowan,

2 cwt. of Tea, at L.40 6s. per cwt. L.
 19 cwt. of Prunes, at 24s. 8d.
 3 cwt. of Tobacco, at L.24 6s. 8d.
 18 cwt. of Pepper, at L.7 14s.
 22 cwt. of Currants, at L.2 5s.

14 barrels Rice, at 18s. 6½d. per barrel,
 32 hhds. Lintfeed, at L.2 15s. 9d. per cwt.

L.918 12 10½

Discount at 7½ per cent.

By Cash,

L.849 15 0
 JAMES COWAN.

Glasgow, 17th August, 1797.

Mr. George Huntly,

Bought of Alexander Gordon,

200½ yards Drugget, at 7s. 4½d. per yard,
 1600½ yards black Cloth, at 15s. 7½d.
 910½ yards broad Cloth, at 16s. 5½d.
 820½ yards Shalloon, at 1s. 9½d.
 54½ yards fine Spanish Black, at 19s. 3d.
 2500½ yards Serge, at 1s. 11½d.
 1600½ yards Frieze, at 4s. 9½d.
 63½ yards superfine Scarlet, at 18s. 5½d.

L.2886 18 7½

By Cash,

2886 18 7½

ALEX. GORDON.

Paisley, 24th Sept. 1797.

Mr. Joseph Smack,

Bought of Peter Small,

2100 ells Dowlas, at 1s. 3½d. per ell
 250 ells Holland, at 4s. 5½d.
 3500 ells Diaper, at 11½d.
 6000 Damask Napkins, at 2s. 3½d. each,
 2246 yards printed Linen, at 2s. 1½d.
 600 yards Cambric, at 11s. 7½d.
 230 yards Muslin, at 7s. 4½d.
 7000 yards of Canvas, at 3s. 7½d.

L.2997 7 3

By Cash,

2997 7 3

PETER SMALL.

Greenock, 20th Oct. 1797.

Mr. Simon Tod,

Bought of Timothy Bruce,

250½ lib. Raisins of the Sun, at 4½d. per lib.
 360 lib. Malaga Raisins, at 4½d.
 3700 lib. Currants, at 6½d.
 35 Sugar Loaves, wt. 17½ lib. each, at 8½d.
 3500 lib. Sugar, at 6½d.
 610 lib. Rice, at 4½d.
 6700 lib. Cloves, at 11½d.
 900 lib. black Pepper, at 1s. 5½d.

L.730 13 10½

By Cash,

730 13 10½

TIMOTHY BRUCE.

ing his knowledge of the *different methods* of computation which he has been learning, and familiarizes him to the employment of the compting-house so far, as to prepare him with some idea of what he is to expect there, and the necessity of previously studying the arts of calculation with a patient and eager application.

Acc^t on Book debt
Mr. Samuel Summer

To Autumn Winter & Co

1798

June 26 20 pieces calicoes each 25 $\frac{1}{4}$ yards at 2/6. £

30 " " " 15 $\frac{1}{2}$ " " 2/9

16 " " " 22 $\frac{7}{8}$ " " 3/

18 " " " 16 $\frac{3}{8}$ " " 2/9

£ 223. 14. 9 $\frac{3}{4}$

1798

Aug^t 6 By Cash £ 28. 18. 6

Sep. 7 By Cash 150. " "

178. 18. 6

Abated

44. 16. 3 $\frac{3}{4}$

2. 10. "

£ 42. 6. 3 $\frac{3}{4}$

London. Nov. 3. 1798 Rec^d Bill at 3 months date in full
for above Autumn Winter & Co

Blackburn, 20. 11. 1891.

Wm. Lloyd Garrison

100

100

11

1890

1871

11

1872

1870

Halifax Jan^y 2nd 1798.
Mr. James. Fancy

Bought of W. Fashion & Co. y

6 Sundry striped calicoes	28/6	£
" " durants	30/	
1 Black calicoe, 30 x 20 N ^o 1.	29/	
1 " " " " " 2	33/	
1 " " " " " 3	38/	
N ^o 1. 5 1/2 yds Scarlet printed Kerseymere	4/8	
12 1/2 " " " " " "	5/6	
Wrapper		
		£ 28. 17. 5

Sir

Agreeably to your esteemed Order, we have sent you as above, which we hope will meet your approbation.

Your further commands will be very obliging and respectfully attended to by.

Sir

Your Obed^t Serv^{ts}

W. Fashion & Co. y

[Faint, illegible handwriting covering the page]

L300

London 8th March 1798.

One month after date, pay to me or
order. Three hundred pounds sterling value received of
To M^r. Kenneth Cainer Kenneth Cainer
Merchant London Josiah Mint

N^o 68. L500

Edinburgh 8th March 1798

One month after date pay to M^r.
John Halffpenny or order. Five hundred pounds
value received as per advice from
M^r. Jacob Johnes Sir
Merch^t Your Mo. obed. Servant
London Timoleon Jennings

L6.

Bristol 3^d. May 1798

Received this day from M^r. Sim
Crust Six pounds in full and all demands
Anthony Spring

I have been thinking of you
 a great deal lately and
 wondering how you are getting on.
 I hope you are well and happy.
 I have been very busy lately
 but I will write to you soon.

I have been thinking of you
 a great deal lately and
 wondering how you are getting on.
 I hope you are well and happy.
 I have been very busy lately
 but I will write to you soon.

I have been thinking of you
 a great deal lately and
 wondering how you are getting on.
 I hope you are well and happy.
 I have been very busy lately
 but I will write to you soon.

I have been thinking of you
 a great deal lately and
 wondering how you are getting on.
 I hope you are well and happy.
 I have been very busy lately
 but I will write to you soon.

Mr. Allan Downie,

Edinburgh, 22d October, 1797.

Bought of George Dodridge,

300½ yards Silk, at 15s. 3¼d. per yard,

270½ yards flowered Silk, at 17s. 4¼d.

389 yards Satin, at 10s. 2¼d.

789½ yards Brocade, at 11s. 7¼d.

370 yards Luteftring, at 7s. 3¼d.

L. 1257 8 3

By Cash,

1257 8 3

GEORGE DODRIDGE.

Mr. Robert Camperdown,

1798

Dr. to Andrew M'Cash,

Feb. 15. 19½ oz. Phosphorus, at 5s. 4d. p. oz.

25. 12½ lib. Gum Arabic, at 1s. 8d.
per lib.

March 1. 12 lib. Opium, at 19s. 10d. per lib.

28. 13 cwt. Jesuits Bark, at 15s. 8d.
per cwt.

L. 28 7 10

1798

June 26. By Cash in part L. 10 10 0

Aug. 1. By Cash in part 9 19 0

L. 20 9 0

Balance,

L. 7 18 10

By Bill for the balance at 3 months.

London, 16th Aug. 1798.

ANDREW M'CASH.

INVOICE

Of Goods by Peter Ramfay, per the Unicorn, James Storm,
Master, from Barbadoes for Bristol, on account and risk of
Mr. John Trader, merchant there.

18 hhds. Sugar.

	Cwt	qrs	lbs.		Cwt	qrs	lbs.
J.T.No.1	14	1	16	No. 10	15	1	24
2	13	3	10	11	17	0	14
3	11	0	27	12	16	1	21
4	18	2	19	13	11	3	4
5	16	1	14	14	14	2	18
6	10	0	4	15	13	1	10
7	8	3	24	16	14	1	26
8	14	1	18	17	13	3	19
9	12	2	23	18	15	1	25

Tare 80 } 253 1 8
lb. p. hhd } 12 3 12

L s a L s d
240 1 24 at 2 18 8

18 hhds.

per cwt. }
at 0 13 0 }
per hhd. }

717 1 2½

5 casks Coffee.

No.	Cwt	qrs	lbs	lib
1-5	1	27	Tare	61
2-5	2	14		62
3-5	1	19		61
4-6	3	7		66
5-6	3	18		65

Gross 30 1 11 315
Tare 2 3 7

Nett 27 2 4 at L. 6 12 0

4 casks at 0 8 6
per cask }

183 12 3

45 tons Logwood, at L. 12. 16 per ton

L. 1476 13 5½

Charges.

Porterage, - - - L. 2 0 0
Wharfage, - - - 2 16 0
Custom-house fees, - - - 3 10 0

8 6 0

1484 19 5½

Commission on L. 1484 19 5½, at 5 p. cent.

L. 1559 4 5½

To the Dr. of Mr. John Trader,

16th Feb. 1798.

Errors excepted.

PETER RAMSAY.

TARE AND TRET.

Note, The gross weight of goods is the weight of both goods and package—Tare is an allowance made the purchaser for the package—Trett is an allowance of 4 lib. on 104 lbs. or $\frac{1}{4}$ on goods liable to waste—Cloff is an allowance of 2 lib. on 3 cwt. or $\frac{1}{16}$ for the turn of the scale, or dust, &c. The remainder, when farther allowance is to be made, is called Suttle; when all allowances are made, it is called Nett Weight.

EXAMPLES.

1st, What is the nett weight of 315 cwt. 2 qrs. 21 lib.
Tare, 16 lib. per cwt?

Cwt qrs lbs Cwt qrs lbs
315 2 21 - $\frac{1}{4}$ = 270 2 10 Ans.

2d, What is the nett weight of 336 cwt. 3 qrs. 14 lib.
Tare, 21 lib. per cwt?

Ans. 273 cwt. 2 qrs. 23 lib. 10 oz.

3d, What is the nett weight of 372 cwt. 3 qrs. 14 lib.
Tare 16 lib. per cwt?

Ans. 319 cwt. 2 qrs. 12 lib. nett.

4th, What is the nett weight of 78 cwt. 1 qr. 15 lib.
Tare, 24 lib. per cwt?

Ans. 61 cwt. 2 qrs. 9 lib. 12 oz. $9\frac{1}{4}$ drams.

5th, What is the nett weight of 16 hhds. of tobacco,
each 5 cwt. 1 qr. 19 lib. Tare, per hhd. 100 lib?

Ans. 72 cwt. 1 qr. 20 lib.

6th, What is the nett weight of 7 baskets of raisins, each
weighing 3 cwt. 3 qrs. 10 lib. Tare at 24 lib. per basket?

Cwt qrs lib

Cwt qrs lib

3 3 $10 \times 7 - 24 \times 7 = 25$ 1 14 nett.

7th, What is the nett weight of 20 barrels figs, each 3
cwt. 1 qr. 5 lib. Tare, 14 lib. per barrel?

Ans. 63 cwt. 1 qr. 16 lib.

8th, What is the nett weight of 15 barrels of sugar, each
barrel containing 3 cwt. 1 qr. 15 lib. Tare 24 lib. per bar-
rel?

Ans. 47 cwt. 2 qrs. 5 lib.

9th, What is the nett weight of 5 hhds. of sugar, con-
taining 84 cwt. 1 qr. 21 lib. Tare, 45 lbs. per hhd?

Ans. 82 cwt. 1 qr. 20 lib.

10th, What is the nett weight of 15 barrels of figs, each
containing 2 cwt. 3 qrs. 26 lbs. Tare, 13 lbs. per barrel?

Ans. 42 cwt. 3 qrs. 27 lib.

Note, To find the Trett, the proportion may be as 26 to 1,
instead of 104 to 4.

11th, What is the Trett on (a) 414 cwt. 1 qr. 26 lib?

$a \div 26 = 15$ cwt. 3 qrs. $21\frac{1}{4}$ lib.

12th, What is the Trett on (a) 24 chests of tea, each con-
taining (b) 15 cwt. 3 qrs. 21 lib?

Chests wt lib Cwt qrs lib oz dr
 $a \times b \div 26 = 14$ 2 23 11 $1\frac{1}{4}$

13th, What is the Cloff on (a) 256 cwt. 2 qrs?

Cwt qrs lib

$a \div 168 = 1$ 2 3 Cloff

14th, What is the nett weight of (a) 6 casks of currants,
each (b) 5 cwt. 1 qr. 10 lib. Tare, (c) 45 lib. per cask.
Trett (d) 4 lib. per 104 lib. and Cloff (e) 1 to 168?

5 1 10
6

32 0 4
2 1 18

26) 29 2 14
1 0 $15\frac{1}{4}$

168) 28 1 $26\frac{1}{4}$
0 0 $18\frac{1}{4}$

28 1 $7\frac{6}{11}$ *Ans.*

15th, What is the nett weight of (a) 139 cwt. 1 qr. 22
lib. gros. Tare, (b) 8 lbs. per cwt. Trett, 4 lib. per (c)
104, and Cloff 2 lbs. per (d) 3 cwt?

$a - \frac{1}{14} = r - \frac{1}{26} = r - \frac{1}{168} = 123$ 3 $1\frac{1}{4}$ nett

16th, What is the nett weight of 8 hhds. of tobacco,
weighing gros 73 cwt. 3 qr. 14 lib. Tare, 26 lib. per hhd.
Trett, 4 lib. per 204, and Cloff as usual?

Ans. 68 cwt. 3 qrs. $9\frac{1}{4}$ lib.

17th, In 17 chests of sugar, weighing 120 cwt. 2 qrs.
gros, Tare, 176 lbs. Trett, 4 lib. per 104, how much
nett?

Ans. 114 cwt. 1 qr. $11\frac{1}{4}$ lib.

18th, What is the nett weight of 7 chests of tea, each 16
cwt. 3 qrs. 16 lib. Tare, 20 lbs. per cwt. deducting also
Trett and Cloff?

Ans. 92 cwt. 3 qrs. $10\frac{1}{8}$ lbs. nett weight.

19th, What is the nett weight of (a) 24 casks of coffee,
each (b) 3 cwt. 16 lib. Tare, (c) 14 lbs. per cwt. deduct-
ing also Trett and Cloff?

Cwt qrs lib

$b \times a - \frac{1}{8} - \frac{1}{8} - \frac{1}{8} = 63$ 0 $9\frac{1}{4}$ *Ans.*

20th, What is the nett weight of 4 hhds. of sugar, weigh-
ing as under, allowing for Cloff as before?

No.	1-12	2	14	Tare	110
	2-17	3	10		120
	3-11	1	8		98
	4-16	2	24		114

58 2 0 422

Ans. 52 cwt. 8 qrs. $16\frac{1}{8}$ lbs.

VULGAR FRACTIONS

Are integers broken into different parts, as $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{1}{4}$ are
equal to 1, or in other words, to an integer or whole num-
ber. The upper term is called the Numerator, and the un-
der term the Denominator.

REDUCTION.

CASE I.

To reduce compound fractions to simple ones, (which are
distinguished by the preposition of betwixt them.)

RULE, Multiply all the numerators together for a new
numerator, and all the denominators together for a new de-
nominator.

EXAMPLES.

1st, Reduce $\frac{1}{2}$ of $\frac{1}{4}$ to a simple fraction

$2 \times 3 = 6$
 $3 \times 4 = 12$ *Answer.*

2d, Reduce $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{1}{2}$ to a simple fraction.

Answer $\frac{1}{2}$

3d, Reduce $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$ to a simple fraction.

Answer $\frac{1}{2}$

4th, Reduce $\frac{2}{3}$ of $\frac{1}{2}$ of $\frac{3}{4}$ to a simple fraction.

Answer $\frac{1}{2}$

Note, Sometimes a little of this process may be saved, by neglecting such figures above and below the line, as are the same in both.

5th, Reduce $\frac{4}{7}$ of $\frac{1}{2}$ of $\frac{7}{8}$ to a simple fraction.

$$\frac{4 \times 7 = 28}{6 \times 9 = 54} = \frac{14}{27} \text{ Ans.}$$

6th, Reduce $\frac{6}{11}$ of $\frac{1}{2}$ of $\frac{7}{8}$ to a simple fraction.

$$\frac{11}{110} \text{ Ans.}$$

CASE 2.

To reduce fractions of different denominations to a common denominator.

RULE, Multiply each numerator into all the denominators (except it's own) for a new numerator, and all the denominators together for a common denominator.

EXAMPLES.

1st, Reduce $\frac{1}{2}$ and $\frac{1}{3}$ to a common denominator.

$$1 \times 4 = 4 \text{ new numerator.}$$

$$2 \times 3 = 6 \text{ new denominator.}$$

$$4 \times 2 = 8 \text{ common denominator.}$$

$$\text{thus } \frac{4}{6} \text{ and } \frac{6}{6} \text{ Ans.}$$

2d, Reduce $\frac{1}{2}$, $\frac{1}{3}$ and $\frac{1}{4}$ to a common denominator.

$$\text{Ans. } \frac{3}{12}, \frac{4}{12}, \frac{3}{12}.$$

3d, Reduce $\frac{7}{8}$, $\frac{3}{4}$, $\frac{5}{6}$ and $\frac{8}{9}$ to a common denominator.

$$\text{Ans. } \frac{63}{720}, \frac{540}{720}, \frac{600}{720}, \frac{800}{720}.$$

4th, Reduce $\frac{4}{5}$, $\frac{5}{8}$ and $\frac{7}{9}$ to a common denominator.

$$\text{Ans. } \frac{288}{2160}, \frac{135}{2160}, \frac{180}{2160}.$$

5th, Reduce $\frac{2}{3}$, $\frac{5}{8}$, $\frac{7}{9}$, $\frac{9}{10}$ to a common denominator.

$$\text{Ans. } \frac{4320}{17280}, \frac{11250}{17280}, \frac{13440}{17280}, \frac{15120}{17280}.$$

6th, Reduce $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$ and $\frac{6}{7}$ to a common denominator.

$$\text{Ans. } \frac{1680}{1680}, \frac{1120}{1680}, \frac{420}{1680}, \frac{336}{1680}, \frac{1440}{1680}.$$

CASE 3.

To reduce fractions to their lowest terms.

RULE, Divide the numerator and denominator by any number which will divide them without a remainder, so shall the quotients be the terms of a new fraction, equal in value to the former, and thus continue till you have brought the fraction into it's lowest terms; or, divide them by a common measure, which is thus found, divide the denominator by the numerator, and the remainder by the last divisor or numerator, and so on till nothing remain; then the last divisor is the common divisor for both terms of the fraction.

EXAMPLES.

1st, Reduce $\frac{72}{108}$ to it's lowest terms.

$$\frac{72}{108} = \frac{2}{3} = \frac{1}{1.5} \text{ Ans.}$$

The most perplexing thing a scholar meets with in computing fractions, is to know how to distinguish them by their different names — It will therefore be of advantage to him to study the rules well, at least so far as to enable him to answer the following queries: — What do you understand by denominator — numerator — denomination — integer — quantity — value — compound fraction — simple — mixt — improper — common denominator? &c. &c.

G

2d, Reduce $\frac{3}{4}$ to its lowest terms.

$$\text{Ans. } \frac{3}{4}.$$

Note, By inspection it may be found that an even number can be divided by 2 without a remainder, and a number ending with 5 or 0, can be divided by 5 without a remainder.

EXAMPLES.

3d, Reduce $\frac{1}{2}$ to it's lowest terms.

$$\text{Ans. } \frac{1}{2}.$$

4th, Reduce $\frac{6}{8}$ to it's lowest terms.

$$\text{Ans. } \frac{3}{4}.$$

5th, Reduce $\frac{6}{8}$ to it's lowest terms.

$$\text{Ans. } \frac{3}{4}.$$

6th, Reduce $\frac{1}{2}$ to it's lowest terms.

$$\text{Ans. } \frac{1}{2}.$$

CASE 4.

To reduce a mixt number to an improper fraction.

RULE, Multiply the whole number by the denominator of the fraction, and to the product add the numerator, under which place the denominator.

EXAMPLES.

1st, Reduce $4\frac{1}{2}$ to an improper fraction.

$$4 \times 2 + 1 = 9 \text{ numerator.}$$

$$\text{Subjoin } \frac{1}{2} \text{ denominator.}$$

2d, Reduce $17\frac{4}{9}$ to an improper fraction.

$$17 \times 9 + 4 = 157 \text{ Ans.}$$

3d, Reduce $18\frac{1}{2}$ to an improper fraction.

$$\text{Ans. } \frac{37}{2}.$$

4th, Reduce $23\frac{5}{8}$ to an improper fraction.

$$\text{Ans. } \frac{189}{8}.$$

5th, Reduce $32\frac{1}{3}$ to an improper fraction.

$$\text{Ans. } \frac{97}{3}.$$

6th, Reduce $41\frac{1}{2}$ to an improper fraction.

$$\text{Ans. } \frac{83}{2}.$$

CASE 5.

To reduce an improper fraction to it's terms.

RULE, To reduce improper fractions to whole or mixed numbers, divide the numerator by the denominator.

EXAMPLES.

1st, Reduce $\frac{36}{7}$ to a mixt number.

$$36 \div 7 = 5\frac{1}{7} \text{ Ans.}$$

2d, Reduce $\frac{42}{9}$ to a mixt number.

$$42 \div 9 = 4\frac{6}{9} \text{ Ans.}$$

3d, Reduce $\frac{48}{11}$ to a mixt number.

$$\text{Ans. } 4\frac{4}{11}.$$

4th, Reduce $\frac{110}{11}$ to a mixt number.

$$\text{Ans. } 10.$$

5th, Reduce $\frac{180}{11}$ to a mixt number.

$$\text{Ans. } 16\frac{4}{11}.$$

6th, Reduce $\frac{168}{11}$ to a mixt number.

$$\text{Ans. } 15\frac{3}{11}.$$

CASE 6.

RULE, To reduce fractions from one denomination to another, — if from a lower to a higher, multiply the denominator by the number of the lower that makes one of the higher, if from a higher to a lower, multiply the numerator thereof.

Note, A whole or integral number may be expressed like a fraction, by putting 1 for its denominator, thus 8 is $\frac{8}{1}$.

EXAMPLES.

- 1st, Reduce $\frac{7}{8}$ of a penny to the fraction of a guinea.
 $\frac{7}{8} \times \frac{1}{1} \times \frac{1}{1} = \frac{7}{800}$ guinea. *Ans.*
- 2d, Reduce $\frac{5}{8}$ sh. to the fraction of a pound sterling.
 $\frac{5}{8} \times \frac{1}{20} = \frac{5}{160}$ L. *Ans.*
- 3d, Reduce $\frac{1}{4}$ farthing to the fraction of a L.
 $\frac{1}{4} \times \frac{1}{4} \times \frac{1}{1} \times \frac{1}{1} = \frac{1}{1600}$ L. *Ans.*
- 4th, Reduce $\frac{1}{2}$ sh. to the fraction of a moidore. *Ans.* $\frac{1}{16}$
- 5th, Reduce $\frac{4}{7}$ crown to the fraction of a pound.
Ans. $\frac{4}{7} = \frac{1}{7}$
- 6th, Reduce $\frac{4}{7}$ farthing to the fraction of a shilling.
Ans. $\frac{4}{7} \times \frac{1}{20} = \frac{1}{35}$
- 7th, Reduce $\frac{6}{7}$ penny to the fraction of a guinea.
Ans. $\frac{6}{7} \times \frac{1}{20} = \frac{3}{70}$
- 8th, Reduce $\frac{7}{8}$ lib. to the fraction of a ton.
Ans. $\frac{7}{8} \times \frac{1}{2240} = \frac{7}{17920}$
- 9th, Reduce $\frac{8}{9}$ ounce to the fraction of a cwt.
Ans. $\frac{8}{9} \times \frac{1}{160} = \frac{1}{20}$
- 10th, Reduce $\frac{6}{7}$ ounce to the fraction of a cwt.
Ans. $\frac{6}{7} \times \frac{1}{160} = \frac{3}{560}$
- 11th, Reduce $\frac{1}{2}$ dwt. to the fraction of a lib.
Ans. $\frac{1}{2} \times \frac{1}{24} = \frac{1}{48}$
- 12th, Reduce $\frac{1}{2}$ L. to the fraction of a guinea.
 $\frac{1}{2} \times \frac{20}{1} = \frac{20}{1}$
 $\frac{1}{2} \times \frac{21}{1} = \frac{21}{1}$ guinea

CASE 7.

RULE, Multiply the given numerator by the parts of the denominations between it and that denomination you would reduce it to for a new numerator, which place over the given denominator.

N. B. This Case proves the last.

EXAMPLES.

- 1st, Reduce $\frac{7}{800}$ guinea to the fraction of a penny.
 $7 \times 21 \times 12 = 1764$
 $\frac{1764}{800} = \frac{441}{200}$ penny. *Ans.*
- 2d, Reduce $\frac{5}{80}$ L. to the fraction of a shilling.
 $5 \times 20 = 100$
 $\frac{100}{80} = \frac{5}{4}$ shilling. *Ans.*
- 3d, Reduce $\frac{1}{800}$ L. to the fraction of a farthing.
Ans. $\frac{1}{800}$ farthing.
- 4th, Reduce $\frac{1}{4}$ moidore to the fraction of a shilling.
Ans. $\frac{1}{4}$ shilling.
- 5th, Reduce $\frac{1}{7}$ L. to the fraction of a crown.
Ans. $\frac{4}{7}$ crown.
- 6th, Reduce $\frac{1}{80}$ shilling to the fraction of a farthing.
Ans. $\frac{4}{80} = \frac{1}{20}$ farthing.

- 7th, Reduce $\frac{1}{176}$ guinea to the fraction of a penny.
Ans. $\frac{6}{176}$ penny.
- 8th, Reduce $\frac{7}{880}$ ton to the fraction of a lib.
Ans. $\frac{7}{880}$ lib.
- 9th, Reduce $\frac{8}{112}$ cwt. to the fraction of an ounce.
Ans. $\frac{8}{112}$ ounce.
- 10th, Reduce $\frac{6}{112}$ cwt. to the fraction of an ounce.
Ans. $\frac{6}{112}$ ounce.
- 11th, Reduce $\frac{1}{112}$ lib. to the fraction of a dwt.
Ans. $\frac{1}{112}$ dwt.
- 12th, Reduce $\frac{60}{112}$ guinea to the fraction of a L.
Ans. $\frac{3}{8}$ L.

CASE 8.

To bring a fraction to value.

RULE, Multiply the numerator by the integer, and divide by the denominator, if any thing remain multiply it by the next inferior denomination, and divide as before.

EXAMPLES.

- 1st, What is the value of $\frac{1}{8}$ of a pound sterling?
 $3 \times 20 \div 8 = \text{Lo } 7 \text{ } 6$
- 2d, What is the value of $\frac{1}{8}$ of a guinea?
Ans. 7s. 10 $\frac{1}{2}$ d.
- 3d, What is the value of $\frac{1}{4}$ of a lib. Avoirdupoise?
Ans. 12 oz.
- 4th, What is the value of $\frac{8}{9}$ of a ton?
Ans. 17 cwt. 3 qrs. 3 lib. 1 oz. 12 $\frac{1}{2}$ dwt.
- 5th, What is the value of $\frac{1}{16}$ of a pound sterling?
Ans. L. 0 0 8 $\frac{1}{2}$ s.
- 6th, What is the value of $\frac{4}{7}$ of a half crown?
Ans. 2 shillings.
- 7th, What is the value of $\frac{4}{7}$ of a cwt.
Ans. 1 qr. 21 lib. 12 oz. 7 $\frac{1}{2}$ dr.
- 8th, What is the value of $\frac{1}{2}$ of an ell English?
Ans. 3 qrs.
- 9th, What is the value of $\frac{1}{4}$ of a mile?
Ans. 3 f. 17 p. 0 yd. 2 feet, 4 in. 0 $\frac{1}{2}$ b. corn.

CASE 9.

RULE, Reduce the given quantity to the lowest term mentioned for a numerator, then reduce the integral part to the same term for a denominator, which will be the fraction required.

EXAMPLES.

- 1st, Reduce 3s. to the fraction of a pound sterling.
 $3 \times 12 = 36 = 3$
 $\frac{36}{12} = 3$ L. *Ans.*
- 2d, Reduce 6 $\frac{1}{2}$ d. to the fraction of a shilling.
Ans. $\frac{13}{40}$

3d, Reduce 8½d. to the fraction of a crown.

Ans. $\frac{17}{110}$ crown

4th, Reduce 9½d. to the fraction of a pound.

Ans. $\frac{19}{110}$ L.

5th, Reduce 6 cwt. 2 qrs. to the fraction of a ton.

$$\frac{6 \times 4 + 2 = 26}{1 \times 20 \times 4 = 80} = \frac{13}{40} \text{ ton } \textit{Ans.}$$

6th, Reduce 6s. 9½d. to the fraction of a guinea.

Ans. $\frac{103}{110}$ guinea

7th, Reduce 5 days, 3 hours, 17 min. to the fraction of a year, consisting of 365 days, 6 hours.

Ans. $\frac{11181}{100000}$

8th, Reduce 7 fur. 4 poles, to the fraction of a mile.

Ans. $\frac{71}{100}$ mile.

ADDITION OF VULGAR FRACTIONS.

RULE 1.

If the given fractions have all the same denominators, add the numerators, and place the sum over the denominator.

EXAMPLES.

1st, What is the sum of $\frac{4}{5} + \frac{6}{5}$? *Ans.* $\frac{10}{5} = 2$

2d, What is the sum of $\frac{1}{5} + \frac{6}{5}$? *Ans.* $\frac{7}{5}$

3d, What is the sum of $\frac{3}{8} + \frac{7}{8} + \frac{2}{8}$? *Ans.* $\frac{12}{8} = 1\frac{3}{2}$

RULE 2.

If the given fractions have different denominators, reduce them to a common denominator by Case 2d; then add the numerators, and place the sum over the common denominator.

EXAMPLES.

1st, What is the sum of $\frac{1}{2} + \frac{1}{4}$?

Ans. $\frac{1}{2} + \frac{1}{4} = \frac{2}{4} + \frac{1}{4} = \frac{3}{4}$ by Case 2d, and $\frac{3}{4} + \frac{1}{4} = \frac{4}{4} = 1$ by Case 5th.

2d, What is the sum of $\frac{1}{2} + \frac{1}{4} + \frac{1}{8}$?

Ans. $\frac{1}{2} + \frac{1}{4} + \frac{1}{8} = \frac{4}{8} + \frac{2}{8} + \frac{1}{8} = \frac{7}{8}$ by Case 2d, and $\frac{7}{8} + \frac{1}{8} = \frac{8}{8} = 1$ by Case 5th.

3d, What is the sum of $\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16}$?

Ans. $2\frac{13}{16}$

4th, What is the sum of $\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16}$?

Ans. $1\frac{7}{8}$

5th, What is the sum of $\frac{1}{2} + \frac{1}{4}$? *Ans.* $1\frac{1}{4}$

6th, What is the sum of $\frac{1}{2} + \frac{1}{4} + \frac{1}{8}$? *Ans.* $2\frac{3}{8}$

RULE 3.

If mixed numbers be given, or if mixed numbers and fractions be given, reduce the mixed numbers to improper fractions by Case 4th; then reduce the fractions to a common denominator by Case 2d, and add the numerators; or reduce only the fractions, and add the integers arising from the ad-

dition of them to the integers given in the question, which were not included in the operation.

EXAMPLES.

1st, What is the sum of $9\frac{1}{2} + 5\frac{1}{2}$?

Ans. $9\frac{1}{2} + 5\frac{1}{2} = 9 + 5 = 14$ by Case 4th, and $\frac{1}{2} + \frac{1}{2} = 1$ by Case 2d, and $14 + 1 = 15$ by Case 5th.

2d, What is the sum of $5\frac{1}{2} + 4\frac{1}{2}$?

Ans. $5\frac{1}{2} + 4\frac{1}{2} = 5 + 4 = 9$ by Case 4th, and $\frac{1}{2} + \frac{1}{2} = 1$ by Case 2d, and $9 + 1 = 10$ by Case 5th.

The operations by Case 2.

What is the sum of $9\frac{1}{2} + 5\frac{1}{2}$?

Ans. $\frac{1}{2} + \frac{1}{2} = 1$ by Case 2d, and $9 + 5 = 14$ by Case 4th, and $14 + 1 = 15$ by Case 5th.

What is the sum of $5\frac{1}{2} + 4\frac{1}{2}$?

Ans. $6\frac{1}{2}$

What is the sum of $48\frac{1}{2} + 64\frac{1}{2} + 130\frac{1}{2}$?

Ans. $243\frac{1}{2}$

RULE 4.

If any or all of the given fractions be compound, first reduce compound fractions to simple ones by Case 1st, then reduce the simple fractions to a common denominator by Case 2d, and add the numerators for the answer.

EXAMPLES.

1st, What is the sum of $\frac{1}{2} + \frac{1}{4}$ of $\frac{1}{2}$?

Ans. $\frac{1}{2}$ of $\frac{1}{2} = \frac{1}{4}$ by Case 1st, and $\frac{1}{4} + \frac{1}{4} = \frac{2}{4} = \frac{1}{2}$ by Case 2d, and $\frac{1}{2} + \frac{1}{2} = 1$ by Case 5th.

2d, What is the sum of $\frac{1}{2}$ of $\frac{1}{2} + \frac{1}{4}$ of $\frac{1}{2}$? *Ans.* $\frac{1}{4}$

RULE 5.

If the given fractions be of different denominations, first reduce them to the same denomination by Case 6th, then reduce the fractions, now of one denomination, to a common denominator by Case 2d, and add the numerators, or reduce each of the given fractions separately to value by Case 8th, and then add their values.

EXAMPLES.

1st, What is the sum of $\frac{1}{2}$ shilling, and $\frac{1}{4}$ L.?

METHOD 1.

$\frac{1}{2}$ sh. = $\frac{1}{2}$ of $\frac{1}{20}$ L. = $\frac{1}{40}$ L. by Case 6th, and $\frac{1}{40} + \frac{1}{40} = \frac{2}{40} = \frac{1}{20}$ by Case 2d, and $\frac{1}{20} + \frac{1}{20} = \frac{2}{20} = \frac{1}{10}$ by Case 8th.

METHOD 2.

$\frac{1}{2}$ L. = $\frac{1}{2} \times 10 = 5$ sh. by Case 6th, and $\frac{1}{4}$ L. = $\frac{1}{4} \times 10 = 2\frac{1}{2}$ sh. by Case 2d, and $5 + 2\frac{1}{2} = 7\frac{1}{2}$ sh. = 8s. 3½d. *Ans.*

METHOD 3.

$\frac{1}{2}$ sh. = $\frac{1}{2} \times 12 = 6$ d. = 0 9½d. } by Case 8th.
 $\frac{1}{4}$ L. = $\frac{1}{4} \times 10 = 2\frac{1}{2}$ sh. = 7 6d. }
 8 3½d. *Ans.*

MORE EXAMPLES.

2d, What is the sum of $\frac{1}{2} + \frac{1}{3} + \frac{1}{4}$?

$$1 \times 3 \times 5 = 15$$

$$2 \times 2 \times 5 = 20$$

$$3 \times 2 \times 3 = 18$$

$$\begin{array}{r} 53 \\ \hline 2 \times 3 \times 5 = 30 \\ \hline \end{array} = 1\frac{23}{30} \text{ Ans.}$$

3d, What is the sum of $\frac{1}{4}$ of $\frac{1}{2} + \frac{1}{10}$ of $\frac{1}{6} + \frac{1}{8}$?

$$\text{Ans. } 1\frac{23}{80}$$

4th, What is the sum of $1\frac{1}{2}$ of $\frac{1}{3} + \frac{1}{5}$ of $\frac{1}{10}$?

$$\text{Ans. } 1\frac{14}{15}$$

5th, What is the sum of $4\frac{1}{2} + 7\frac{1}{3} + 8\frac{1}{4}$?

$$\text{Ans. } 20\frac{1}{12}$$

6th, What is the sum of $\frac{1}{2}$ sh. + $\frac{1}{4}$ L?

$$\text{Ans. L. 0 16 9}$$

7th, What is the sum of $\frac{1}{6}$ sh. + $\frac{1}{3}$ L?

$$\text{Ans. L. 0 9 4\frac{1}{2}}$$

8th, What is the sum of $\frac{1}{5}$ L. + $\frac{1}{7}$ sh. + $\frac{1}{8}$ d?

$$\text{Ans. L. 0 18 5\frac{1}{8}}$$

9th, What is the sum of $\frac{1}{4}$ crown + $\frac{1}{2}$ L. + $\frac{1}{4}$ guinea?

$$\text{Ans. L. 1 13 1\frac{1}{4}}$$

10th, What is the sum of $\frac{1}{4}$ lib. + $\frac{1}{2}$ oz. + $\frac{1}{4}$ dwt.

$$\text{Ans. 4 oz. 19 dwts. 16\frac{1}{4} grains.}$$

11th, What is the sum of $\frac{1}{4}$ of $\frac{1}{8}$ of a league added to $\frac{1}{4}$ furlong?

$$\text{Ans. 5 fur. 12 poles.}$$

12th, What is the sum of $\frac{1}{12}$ year + $\frac{1}{2}$ day?

$$\text{Ans. 335 days, 0 hours, 17 min. 8\frac{1}{2} sec.}$$

CRITERION.

9 cwt. 3 qrs. 26 lib. + 1 cwt. 2 qrs. 16 lib. + 6 cwt. 3 qrs.
 12 lib. + 6 ton, 5 cwt. 3 qrs. + 12 oz. 10 dr. = 4 ton, 5
 dr. = $r \times 6\frac{1}{2} = p \div 16\frac{1}{2} = q : L. 186 \quad 5 \quad 8 :: 2 \text{ oz. } : q + \frac{5}{8}$
 of $\frac{1}{2}$ L. + $\frac{1}{4}$ sh. + $\frac{1}{8}$ d. = L. 0 6 7\frac{1}{2}.

SUBTRACTION
OF VULGAR FRACTIONS.

RULE 1.

If the given fractions have the same denominators, subtract the lesser numerator from the greater, and place the remainder over the denominator.

EXAMPLES.

$$1\text{st, } \frac{6}{11} - \frac{3}{11} = \frac{3}{11} \quad 2\text{d, } \frac{6}{9} - \frac{4}{9} = \frac{2}{9} \quad 3\text{d, } \frac{4}{15} - \frac{3}{15} = \frac{1}{15}$$

RULE 2.

If the given fractions have different denominators, reduce them to a common denominator by Case 2d, then subtract

the lesser numerator from the greater, and place the remainder over the common denominator.

EXAMPLES.

1st, From $\frac{8}{9}$ take $\frac{6}{9}$.

$$\frac{8}{9} - \frac{6}{9} = \frac{2}{9} \text{ by Case 2d, then } \frac{2}{9} - \frac{1}{9} = \frac{1}{9} \text{ Ans.}$$

2d, From $\frac{8}{9}$ take $\frac{2}{3}$.

$$\text{Ans. } \frac{2}{9}$$

3d, From $\frac{10}{11}$ take $\frac{7}{11}$.

$$\text{Ans. } \frac{3}{11}$$

RULE 3.

If it be required to subtract one mixt number from another, or to subtract a fraction from a mixt number, reduce the mixt number to improper fractions by Case 4th, then reduce the fractions to a common denomination by Case 2d, and subtract the one numerator from the other.

EXAMPLES.

1st, From $4\frac{1}{2}$ subtract $6\frac{1}{2}$.

$$4\frac{1}{2} - 6\frac{1}{2} = -2\frac{0}{2} \text{ by Case 4th.}$$

$$\text{and } \frac{2}{2} - \frac{1}{2} = \frac{1}{2}, \frac{4}{2} \text{ by Case 2d.}$$

$$\text{and } \frac{2}{2} - \frac{4}{2} = -\frac{2}{2} = -1 \text{ by Case 5th.}$$

2d, From $8\frac{1}{2}$ subtract $9\frac{1}{2}$.

$$8\frac{1}{2} - 9\frac{1}{2} = -1\frac{0}{2} \text{ by Case 4th.}$$

$$\text{and } \frac{4}{4} - \frac{6}{4} = -\frac{2}{4}, \frac{3}{4} \text{ by Case 2d.}$$

$$\frac{3}{4} - \frac{2}{4} = \frac{1}{4} \text{ Ans.}$$

3d, From $6\frac{1}{2}$ subtract $8\frac{1}{2}$.

$$\text{Ans. } -2\frac{0}{2}$$

4th, What is the difference between $\frac{1}{2}$ of $\frac{1}{4}$ and $\frac{1}{8}$ of $\frac{1}{4}$?

$$\text{Ans. } \frac{1}{8}$$

5th, What is the difference of $14\frac{1}{2} - 19\frac{1}{2}$?

$$\text{Ans. } -5\frac{0}{2}$$

Note, Prepare the quantities by Reduction in the same way as pointed out in Addition, then subtract.

6th, What is the difference between $\frac{1}{4}$ L. and $\frac{1}{8}$ shilling?

$$\text{Ans. 14s. 2d.}$$

7th, What is the difference between $\frac{1}{2}$ shil. and $\frac{1}{4}$ penny?

$$\text{Ans. 5d. 4f.}$$

8th, What is the difference between $\frac{1}{2}$ oz. and $\frac{1}{4}$ dwt?

$$\text{Ans. 11 dwts. 7\frac{1}{2} gr.}$$

9th, What is the difference between $\frac{1}{2}$ cwt. and $\frac{1}{4}$ lib?

$$\text{Ans. 2 qrs. 10 lib. 8 oz. 8\frac{1}{2} dr.}$$

10th, What is the difference between $\frac{1}{2}$ league and $\frac{1}{4}$ mile?

$$\text{Ans. 6 fur. 26 poles, 3 yds. 2 feet.}$$

11th, What is the difference between $\frac{1}{4}$ ells English, and $\frac{1}{8}$ qr?

$$\text{Ans. 2 qr. 3 n. 1\frac{1}{2} inch.}$$

Note, 48 gallons of ale make a hoghead.

12th, What is the difference between $\frac{1}{4}$ hhd. ale, and $\frac{1}{8}$ gal?

$$\text{Ans. 41 gal. 1\frac{1}{2} pint.}$$

CRITERION.

1 hhd. 54 gal. 2 qts. 1 pint + 3 t. 3 hhds. 26 gal. 3 qts.
 1 pint + 3 qts. 1 pint + 3 hhds. 1 pint + 2 t. 3 hhds. 3 qts. =
 - 5 t. 2 hhds. 62 gal. 1 qt. = $r \times 6\frac{1}{2} = p \div 5\frac{8}{9} = q$ at 3s. 4\frac{1}{2}d.
 per gallon, = $p : 16 \text{ cwt. } 3 \text{ qr. } - 16 \text{ lib. tare } :: L. 500 = p$

sh. $\frac{1}{2}$ d. = L. 119 $\frac{1}{2}$ = $r \times 3\frac{1}{2}$ = $p \div \frac{1}{2}$ of $\frac{1}{8}$ = L. 139 15 11 $\frac{1}{2}$
Ans. nearly.

RULE OF THREE IN VULGAR FRACTIONS.

RULE.

Prepare the fractions according to the preceding rules, then proceed as in whole numbers.

EXAMPLES.

1st, If $\frac{1}{4}$ yard of cloth cost $\frac{1}{2}$ L. what will $\frac{3}{8}$ yard cost at that rate?

$$\begin{array}{l} \text{yd} \quad L \quad \text{yd} \\ \text{If } \frac{1}{4} : \frac{1}{2} :: \frac{3}{8} : \\ \text{For } 4 \times 3 \times 9 = 108 \\ \quad 1 \times 5 \times 10 = 50 \\ \text{or } \frac{1}{4} \times \frac{3}{8} = \frac{3}{32} \quad \frac{1}{2} \times \frac{3}{8} = \frac{3}{16} \quad L. 2 \quad 3 \quad 2\frac{1}{2} \text{ } \text{Ans.} \end{array}$$

2d, If $\frac{1}{2}$ yard of cloth cost $\frac{1}{2}$ L. what will $3\frac{1}{2}$ yards cost at that rate? *Ans.* L. 5 1 4

3d, If (a) $3\frac{1}{2}$ cwt. of sugar cost (b) L. 13 10, what will (c) $9\frac{1}{2}$ cwt. cost?

$$\begin{array}{l} \text{cwt} \quad L \quad \text{cwt} \\ a : b :: c : L. 38 \quad 3 \quad 8\frac{1}{2} \text{ } \text{Ans.} \end{array}$$

4th, If (a) $\frac{1}{4}$ oz. of silver cost (b) $6\frac{1}{2}$ sh. what will (c) 3 oz. cost at that rate? *Ans.* L. 1 6 4 $\frac{1}{2}$

$$\begin{array}{l} \text{oz} \quad s \quad \text{oz} \\ a : b :: c : L. 1 \quad 6 \quad 4\frac{1}{2} \text{ } \text{Ans.} \end{array}$$

5th, What is the value of (a) $\frac{1}{8}$ of a ship when (b) $\frac{1}{2}$ of $\frac{1}{2}$ cost (c) L. 500 $\frac{1}{4}$?

$$\text{If } b : c :: a : L. 6257 \quad 16 \quad 3 \text{ } \text{Ans.}$$

6th, If a Cardinal can pray a soul out of hell in an hour, a Bishop in three, a Priest in five, and a Friar in seven, in what time can they pray out three souls, praying altogether?

$$1 + \frac{1}{3} + \frac{1}{5} + \frac{1}{7} = \frac{176}{105} \quad \text{If } 176 : 3 :: 105 : 1 \quad 47 \quad 23 \text{ } \text{Ans.}$$

7th, Bought (a) 10 gold trinkets, each weighing (b) 1 oz. 18 dwts. what did they cost altogether in weight of guineas, allowing (c) $44\frac{1}{2}$ guineas to a (d) pound troy, and deducting (e) $\frac{1}{4}$ for workmanship?

$$\begin{array}{l} \text{lib.} \quad \text{Gs.} \quad \text{oz} \quad \text{gt} \quad \text{Gs} \quad s \quad d \\ \text{If } d : c :: b \times a - e : 61 \quad 13 \quad 8\frac{1}{2} \text{ } \text{Ans.} \end{array}$$

8th, Reckoning the velocity of sound to be 1142 feet in a second, and that of a cannon bullet to be 1500 feet in a second, and supposing a 36 pound shot fired at a ship from a fort 2 miles off—what time will the shot reach the ship before the sound? *Ans.* 2 sec. $\frac{2954}{1142}$

9th, The diameter of a pipe which empties a cistern in 12 hours is $9\frac{1}{2}$ inches, in what time will a pipe do it whose diameter is $6\frac{1}{2}$ inches? *Ans.* 27 hours.

10th, A traveller on a journey from Glasgow to Edinburgh, a distance of 44 miles, being met by a person going to Glasgow who asked him how far he had to travel, said

that $\frac{1}{4}$ of the road he had past was equal to $\frac{1}{4}$ of the road before him, how far had he to travel?

$$\frac{1}{4} + \frac{1}{4} = 31 : 44 :: 15 : 21\frac{1}{2} \text{ to travel} \\ : 44 :: 16 : 22\frac{1}{2} \text{ travelled}$$

44 proof

11th, If 6 the 7th of 30 be, what is the 9th of 93?

$$\text{As } \frac{10}{7} : \frac{6}{7} :: \frac{93}{9} : 14\frac{11}{10}$$

12th, Two persons travelling together, the one says to the other your height is 5 feet, 11 $\frac{1}{2}$ inches, and your shadow is 9 feet, 5 $\frac{1}{2}$ inches, might not we measure the height of yon steeple, which gives a shadow of 496 $\frac{1}{2}$ feet? By such a proportion they did so, and found it to be 314 feet, 3 $\frac{1}{2}$ inches.

DECIMAL FRACTIONS

Are wrought along with, and much in the same way as integers. Their value encreases or decreases in a tenfold proportion, according to their distance from their characteristic point, or unity; the integers encreasing from the point towards the left hand, and the decimals decreasing towards the right.

REDUCTION.

CASE I.

To reduce a vulgar fraction to a decimal.

Make the numerator the dividend, and the denominator the divisor, annexing cyphers to continue the division till it be proper to stop.

FINITE DECIMALS.

EXAMPLES.

$$\frac{1}{2} = .5, \quad \frac{3}{4} = .75, \quad \frac{1}{4} = .25 \\ \frac{1}{8} = .125, \quad \frac{1}{16} = .0625, \quad \frac{1}{32} = .03125$$

Note, 2 and 5 with their multipliers produce finite decimals. When the division is terminated, if there be not as many places in the quotient as there were cyphers annexed, prefix as many on the left as will make up the want.

INFINITE DECIMALS.

There are four kinds of repeating decimals, and which are marked by a dote above them.

1st, A pure repeater, which is produced from 3 and 9, as

$$\frac{1}{3} = .3 \quad \frac{1}{9} = .1 \quad \frac{2}{9} = .2$$

2d, A mixed repeater, which is produced from .2 and 5 and their powers by 3 and 9 as

$$\frac{2}{3} = .052083 \quad \frac{1}{9} = .0052083 \quad \frac{1}{3} = .16$$

3d, A pure circulate is produced from all prime numbers (except 2, 3 and 5) from 9 multiplied into 3 or any of its powers, having as many places as the number which 9 is multiplied into, has units.

$$\frac{1}{7} = .142857, \frac{1}{14} = .0714285, \frac{1}{17} = .0588235, \frac{1}{19} = .0526315, \frac{1}{23} = .0434782, \frac{1}{29} = .0344827, \frac{1}{31} = .0322580, \frac{1}{37} = .0270270, \frac{1}{41} = .0243902, \frac{1}{43} = .0232558, \frac{1}{47} = .0212766, \frac{1}{53} = .0188679, \frac{1}{59} = .0169491, \frac{1}{61} = .0163934, \frac{1}{67} = .0149254, \frac{1}{71} = .0140845, \frac{1}{73} = .0136986, \frac{1}{79} = .0126582, \frac{1}{83} = .0120482, \frac{1}{89} = .0112360, \frac{1}{97} = .0103093$$

4th, Mixt circulates are produced from fractions whose denominators are primes, multiplied into 2, 5 or 10, or into some of their powers or product of their powers, as

$$\frac{1}{12} = .083333, \frac{1}{15} = .066666, \frac{1}{18} = .055555, \frac{1}{20} = .05, \frac{1}{25} = .04, \frac{1}{30} = .033333, \frac{1}{36} = .027777, \frac{1}{40} = .025, \frac{1}{45} = .022222, \frac{1}{50} = .02, \frac{1}{60} = .016666, \frac{1}{72} = .013888, \frac{1}{80} = .0125, \frac{1}{90} = .011111, \frac{1}{100} = .01$$

CASE 2.

To reduce different denominations to decimals.

Turn the given quantities into vulgar fractions, and proceed as above, annexing cyphers to prolong the division, &c.

EXAMPLES.

$$8 \text{ sh} = \frac{8}{20} \text{ L} = .4 \text{ L} \quad 6 \text{ d} = \frac{6}{12} \text{ sh} = .5 \text{ sh} \div 20 = .025 \text{ L} \\ \frac{1}{4} \text{ d} = .75 \text{ sh} \div 12 = .0625 \text{ sh} \div 20 = .003125 \text{ L} \text{ or } \frac{1}{4} \text{ d} = \frac{1}{80} \text{ L} \\ = .003125 \text{ L} \quad 9 \text{ d} = \frac{9}{12} \text{ sh} = .75 \text{ sh} \div 20 = .0375 \text{ L} \text{ or } 9 \text{ d} = \frac{3}{4} \text{ sh} = .75 \text{ sh} \div 20 = .0375 \text{ L}$$

Note, When several denominations are to be reduced to decimals; as when 5s. 6 $\frac{1}{2}$ d. are to be reduced to the decimal of a pound, either bring the sum to a vulgar fraction thus,

5s. 6 $\frac{1}{2}$ d. = $\frac{56.5}{20}$ L. = 277083 L. making a mixt-repeater; or more simply, divide the farthings by 2 thus, 2)110(.5, then beside the point and 5 place your pence, and divide by 12

thus, 12)65(.54166, then beside .54166 place your shil-

lings, and divide by 20 thus, 20)5.54166(.277083 L.

When a cypher occurs in a series of denominations, as 6s. 0 $\frac{1}{4}$ d. make use of the cypher as if it were any other figure in placing it beside the decimal found, thus, 4)3(.75 then 12)0.75(.0625 $\div$ 20 = .0303125 L.

MORE EXAMPLES.

$$\text{Lo } 19 \text{ } 9\frac{1}{4} = .990625 \text{ L} \quad \text{Lo } 15 \text{ } 6\frac{1}{2} = .7760416 \text{ L}$$

$$\text{Lo } 14 \text{ } 3\frac{1}{2} = .714583 \text{ L} \quad \text{Lo } 6 \text{ } 8 = .3 \text{ L} \quad \text{Lo } 13 \text{ } 4 = .6 \text{ L}$$

Note, Five decimal places are reckoned sufficient for ordinary calculations.

AVOIRDUPOISE WEIGHT.

$$3 \text{ qrs } 15 \text{ lib} = .8839, 285714.28 \text{ cwt. a mixt. circulate}$$

$$2 \text{ qrs } 16 \text{ lib} = .642857 \text{ cwt.}$$

$$3 \text{ lib } 13 \text{ oz} = .0340401785713 \text{ cwt.}$$

TROY WEIGHT.

$$10 \text{ dwt} = \text{lib} .0416 \quad 5 \text{ oz} = \text{lib} .416$$

$$23 \text{ grs} = \text{lib} .00399305$$

WINE MEASURE.

$$2 \text{ gal} = \text{hhd} .31746 \quad 25 \text{ gal } 7 \text{ pints} = \text{hhd} .410, 714285, 7$$

$$33 \text{ gal } 5 \text{ pints} = \text{hhd} .53373$$

LONG MEASURE.

$$6 \text{ in} = \text{foot} .5 \quad 1 \text{ foot, } 8 \text{ in} = .5 \text{ yd. } 2 \text{ f. } 1 \text{ in} = \text{yd} .694$$

TIME.

$$12 \text{ hours} = \text{day} .5 \quad 15 \text{ min} = \text{day} .010416$$

$$23 \text{ hours} = \text{year} .00262557077$$

CASE 3.

To reduce a decimal to it's primitive vulgar fraction.

1st FINITE DECIMALS.

RULE, Place the decimal over 1, with as many cyphers annexed as there are decimal places, then bring it to it's lowest terms.

EXAMPLES.

$$.5 = \frac{5}{10} = \frac{1}{2} \quad .25 = \frac{25}{100} = \frac{1}{4} \quad .75 = \frac{75}{100} = \frac{3}{4}$$

2^d PURE REPEATERS.

RULE, Place 9 for the denominator of the repeater.

$$.3 = \frac{3}{9} = \frac{1}{3} \quad .6 = \frac{6}{9} = \frac{2}{3} \quad .09 = \frac{9}{99} = \frac{1}{11} \quad .36 = \frac{36}{99} = \frac{4}{11}$$

3^d MIXED REPEATERS.

RULE, From the whole fraction subtract the finite part, the remainder is the numerator of the vulgar fraction. Place 9 below each figure of the circle, and a cypher for every finite place.

EXAMPLES.

$$.416 - .41 = 375 = \frac{375}{999} = \frac{125}{333} \quad 16 - 1 = \frac{15}{99} = \frac{5}{33}$$

$$.9583 - .958 = \frac{33}{9999} = \frac{1}{303} \quad 8.3 = \frac{7}{9} = 8\frac{7}{9}$$

CASE 4.

To value decimals.

1st FINITE DECIMALS.

RULE, Multiply the given decimal by the different denominations, successively pointing off to the right the number of places given in the question.

EXAMPLES.

$$\begin{array}{r} L \quad s \quad d \\ 678 \times 20 = 13560, \text{ then } 560 \times 12 = 6720, \text{ then } 720 \times 4 \\ = 2880, \text{ so that } .678 = 13 \text{ } 6\frac{1}{2}, \text{ which may be proved by} \\ \text{Case 2d, and brought to a vulgar fraction by Case 3d, thus,} \\ L \quad s \quad d \\ .678 \text{ or } \frac{678}{1000} = 13 \text{ } 6\frac{1}{2} \end{array}$$

$$\begin{array}{rcl} s & d & L \\ .625 = 7\frac{1}{2} & .8322916 = 16 & 7\frac{1}{2} \\ L & s & d \\ .72065 = 14 & 4\frac{1}{2} & .275 = 5 & 6 \end{array}$$

2d INFINITE DECIMALS.

RULE, Carry at 9 on the right hand, and when a cypher occurs in the multiplier, annex the right hand figure in it's stead. When the multiplier repeats, work as taught in multiplication of infinite decimals.

EXAMPLES

$$\begin{array}{rcl} L & s & d \\ .6 = 13 & 4 & .3L = 6 & 8 \\ & & oz & dwt & gr \\ .52690972 \text{ lib} = 6 & 6 & 11 \end{array}$$

AVOIRDUPOISE WEIGHT.

$$\begin{array}{rcl} Cwt & lib & Cwt & qr & lib & oz \\ .125 = 14 & .6725 = 2 & 19 & 5 & .43569 = 1 & 20 & 12 \end{array}$$

TROY WEIGHT.

$$\begin{array}{rcl} lib & oz & dwt & gr & lib & oz & dwt & lib & oz \\ .9112 = 10 & 18 & 16 & .625 = 7 & 10 & .4166 = 5 \end{array}$$

TIME.

$$\begin{array}{rcl} .12602 \text{ year} = 46 \text{ days} & .525 \text{ day} = 12 \text{ hours, } 36 \text{ min.} \\ .239583 \text{ day} = 5 \text{ hours, } 45 \text{ min.} \end{array}$$

WINE MEASURE.

$$\begin{array}{rcl} .53 \text{ hhd} = 33 \text{ gal } 5 \text{ pts} & .875 \text{ gal} = 3 \text{ qts } 1 \text{ pt} \\ .61 \text{ tun} = 2 \text{ hhds } 27 \text{ gal } 2 \text{ qts } 1 \text{ pint} \end{array}$$

LONG MEASURE.

$$\begin{array}{rcl} .67 \text{ leag} = 2 \text{ m of } 3 \text{ p' } 1 \text{ yd } 3 \text{ in } 1 \text{ bc} \\ .583 \text{ yards} = 1 \text{ ft } 9 \text{ in} & .5 \text{ yards} = 1 \text{ ft } 8 \text{ in} \end{array}$$

OF ENGLISH MONEY.

To value decimals by inspection.

RULE, Double the figure next the point gives shillings; if the next figure be 5, or more than 5, encrease the shillings 1, then the second figure if under, or it's excess above 5, with the third make farthings; but if 25, or above reject 1.

EXAMPLES.

$$\begin{array}{rcl} s & d & s & d & s & d \\ .778125 L = 15 & 6\frac{1}{2} & .678 L = 13 & 6\frac{1}{2} & .75 = 9 \\ s & d & s & d & s & d \\ .825 L = 16 & 6 & .9989583 L = 19 & 11\frac{1}{2} \end{array}$$

To find the decimal of a pound sterling by inspection.

RULE, The figure next the point must be doubled, and the second figure reckoned a shilling; but if it be 5 or more than 5, make it 1 more; after which account the second and third places farthings, abating 1 for every 25.

Note, Because 960 farthings make a pound, and this rule supposing 1000, is the reason why 25 is abated.

EXAMPLES.

$$\begin{array}{rcl} s & d & s & d & s & d \\ .8 = .4 L & Lo & 19 & 9\frac{1}{2} = .990625 & Lo & 15 & 6\frac{1}{2} \\ = .778125 L \end{array}$$

ADDITION OF DECIMALS.

Let the points stand in a column, and the integers and decimals on each side be placed so as units may stand above units, and tens above tens, &c.

CASE 1.

To add finite decimals proceed as in whole numbers, point off in the product as many places from the right as there are places in the longest decimal in the question.

EXAMPLES.

1ft	2d	3d
36.865	3.6836	6.78
96.986	.86	86.75
3.86	.5	83.968
96.587	686.2866	69.5383
168.5968	16.16	5.6396
38.3286	8.683	1.2626

4th, .669 + .386 + 86.96 + 43.8695 + 63.869 + 6.8
 5th, 7.6586 + 368.768 + 8.365 + 586.66 + 9.86 + 3.6
 6th, 9.838 + 76.85 + 9.876 + .5 + .8 + .09 + 7.0009 + .01

CASE 2.

When all or any of the given decimals are single repeaters.

RULE, Give the repeaters as many places and one more than the longest finite, and in adding, carry at 9 in the right hand column.

EXAMPLES.

$$\begin{array}{rcl} 2.6666 & 86.3333 & L & 76 & 13 & 4 & = & 76.66666 \\ 16.789 & 96.3333 & 39 & 6 & 8 & = & 39.33333 \\ 75.5683 & 1.6666 & 87 & 5 & 4 & = & 87.26666 \\ 16.3863 & 7.8133 & 9 & 2 & 7\frac{1}{2} & = & 9.130208 \\ 16.7666 & 6.0833 & 8 & 0 & 0\frac{1}{2} & = & 8.002083 \\ 986.3166 & & 118 & 16 & 3\frac{1}{2} & = & 118.815625 \end{array}$$

CASE 3.

When all or any of the given decimals are circulates, before they can be added or subtracted they must be made similar and conterminous, unless they be so given. Circles of an equal number of places are said to be similar, and such as begin and end equally distant from the decimal point are said to be conterminous. Any figure in a circle may be taken as the first, and dissimilar circles may be made similar by the following

RULE*.

Set aside, by a comma on the left, as many figures as there are places in the lowest finite part, and then prolong the several circles to as many places as will make them similar.

EXAMPLES.

<i>Dissimilar</i>	<i>Pure circulates made similar</i>	<i>Mixt circulates</i>
$\begin{array}{r} \cdot\cdot \\ .63 \end{array}$	$= .636363$	25.1818181
$\begin{array}{r} \cdot\cdot \\ .148, \end{array}$	$.148148$	5.2370370
$\begin{array}{r} \cdot\cdot \\ .714285 \end{array}$	$.714285$	8.3527527

To add circulating Decimals, the numbers being prepared by the foregoing rule.

RULE.

Find the tens in the left hand column, and carry them to the right, then proceed as in Case 1st.

EXAMPLES.

$\begin{array}{r} \cdot\cdot \\ 58.36 \end{array}$	$=$	58.36363636
$\begin{array}{r} \cdot\cdot \\ 2.5740 \end{array}$		2.5740740740
$\begin{array}{r} \cdot\cdot \\ 19.17857142 \end{array}$		19.178571428
$\begin{array}{r} \cdot\cdot \\ 1.23 \end{array}$		1.233333333
$\begin{array}{r} \cdot\cdot \\ 4.625 \end{array}$		4.625
$\begin{array}{r} \cdot\cdot \\ 11.6 \end{array}$		11.666666666
$\begin{array}{r} \cdot\cdot \\ 22.189629 \end{array}$		22.189629629
		119.830911496
$\begin{array}{r} \cdot\cdot \\ 195.407 \end{array}$	$=$	195.4074074074
$\begin{array}{r} \cdot\cdot \\ 2.563 \end{array}$		2.5636363636

* Though circulating decimals are little used in common business, yet in extraordinary calculations; where great precision is required, they then become very necessary;—indeed, there seems to be a want (particularly to teachers) in those school books which contain only a slight sketch of the doctrine, especially when they are confined to finite factors, and pass over those which are infinite.

I

18.3527

19.285714
2.1565,

5.28740

18.3527272727

19.2857142857
2.1565,

5.2874074074

243.0533927368

APPROXIMATES.

When decimals consist of many places it will be sufficiently exact for ordinary purposes to use only the first four or five, and proceed by the following

RULE.

For every two lines left incomplete carry one to the right hand column; omit the right hand figure of the sum of that column as uncertain, but carry the tens to the next column.

*At large**Contracted*

$$\begin{array}{r} 47.98277,43545111111 \\ 175.67329,56125 \\ 2.43752,43125 \\ 97.70200,670416666666 \end{array}$$

$$\begin{array}{r} 47.98277 \\ 175.67329 \\ 2.43752 \\ 97.702 \end{array}$$

276.33333,333333333333

276.33333

58.27272,7272727272

58.27272

$$\begin{array}{r} 9.17857,142857142857 \\ 10.00420,985 \end{array}$$

$$\begin{array}{r} 9.17857 \\ 10.00420 \end{array}$$

677.58444,286830981241

677.58444

CRITERION.

$$\begin{array}{ccccccc} L & s & d & L & L & L & L \\ 7\frac{5}{8} + \frac{6}{9} + \frac{7}{10} - 6\frac{1}{4} \times 4\frac{1}{2} \div 3\frac{1}{8} + .7876 + L.3 + .8753 + \\ s & d & L & s & d & & \\ .678 + .5432 = 3 & 4 & 9\frac{1}{2} \end{array}$$

SUBTRACTION OF DECIMALS.

RULE.

Write down the numbers so that the greatest may be uppermost, and that units may stand under units, tens under tens, as in Addition.

CASE 1.

When the upper and under term are finite, proceed as in Subtraction of integers.

EXAMPLES.

$$\begin{array}{r} 67.85 \\ 45.63675 \\ \hline 22.21325 \end{array}$$

$$\begin{array}{r} 4347.125 \\ 124.16 \\ \hline \end{array}$$

$$\begin{array}{r} 586.475 \\ 278.7464 \\ \hline \end{array}$$

$$\begin{array}{r} L15 \quad 7 \quad 6\frac{1}{4} = 15.378125 \\ 12 \quad 16 \quad 9 \quad 12.8375 \end{array}$$

$$\begin{array}{r} L45 \quad 0 \quad 0\frac{1}{4} = 45.003125 \\ 34 \quad 2 \quad 9 \quad 34.1375 \end{array}$$

$$L10 \quad 17 \quad 3\frac{1}{4} = 10.865625$$

CASE 2.

When the upper and under term or any of them terminate in a repeater, make both upper and under terms equal.— When only one of them repeats, carry it one place beyond the longest finite, and in both of these cases remember to carry 9 on the right hand figure, and proceed with the rest as in integers.

EXAMPLES:

$$\begin{array}{r} 93.5 \\ 25.2083 \\ \hline 68.2916 \end{array}$$

$$\begin{array}{r} 199.0833 \\ 189.0375 \\ \hline 10.0457 \end{array}$$

$$\begin{array}{r} 76.683 \\ 39.266 \\ \hline 37.416 \end{array}$$

$$\begin{array}{r} L \quad s \quad d \\ 120 \quad 13 \quad 4 = 120.6666 \\ 84 \quad 7 \quad 6 \quad 84.375 \end{array}$$

$$\begin{array}{r} 36 \quad 5 \quad 10 \quad 36.2916 \end{array}$$

CASE 3.

When one or both terms end in a circle, prepare both terms as directed in Addition of Circulates, and when the left hand figure of the under term is greater than the figure immediately above it, add 1 to the figure on the right hand of the lower term before you begin to subtract, then proceed as in Case 1st.

$$\begin{array}{r} 226.592,592 \\ 120.148 \\ \hline 106.444,592 \end{array}$$

$$\begin{array}{r} 1214.714285, \\ 195.28746 \\ \hline 1019.426825 \end{array}$$

$$\begin{array}{r} 92.18,18,18 \\ 42.36,36,36 \\ \hline 49.81,81,81 \end{array}$$

$$\begin{array}{r} 980.142857, \\ 896.333333 \\ \hline 83.809523 \end{array}$$

$$L25 \quad 13 \quad 4 = 25.6666666$$

$$\begin{array}{r} 16 \quad 0 \quad 0\frac{1}{2} \quad 16.0020833 \\ \hline \end{array}$$

$$L9 \quad 13 \quad 3\frac{1}{2} \quad 9.6645833$$

APPROXIMATES.

Operations in Subtraction may be considerably abridged by the following

RULE.

Neglect the right hand figure of the remainder, but pay one to the next place on the left hand when you borrow on the right.

<i>At large</i>	<i>Contracted</i>
920.2572585	920.2572
668.45937416	668.4593
251.79788433	251.797
868.568125	868.5681
496.9631343	496.9631
371.6049906	371.604

CRITERION.

$$\begin{array}{r} L \quad s \quad d \quad L \\ 16\frac{1}{2} + \frac{1}{8} + \frac{1}{8} + .546 + .14586 \text{ guin.} + \frac{1}{4} \text{ joan.} = L \\ 583 = 10.105112 \end{array}$$

MULTIPLICATION OF DECIMALS.

In this rule place the multiplicand over the multiplier, as in Multiplication of Integers, without minding the decimal point.

CASE 1.

Proceed as in whole numbers, point off as many decimal places to the right hand of the product as there are decimal places on both the multiplicand and the multiplier.

Note, When the product has not so many decimal places as the multiplicand and the multiplier, set down as many cyphers betwixt the point and the figures as will make up the number.

EXAMPLES.

$$\begin{array}{r} 37682.75 \\ .365 \\ \hline \end{array}$$

$$\begin{array}{r} 485.32956125 \\ 122 \\ \hline \end{array}$$

$$\begin{array}{r} 18841375 \\ 22609650 \\ 11304825 \\ \hline \end{array}$$

$$\begin{array}{r} 97065912250 \\ 97065912250 \\ 48532956125 \\ \hline \end{array}$$

$$13754.20375$$

$$59210.20647250$$

$$\begin{array}{r}
 1416.3178925 \\
 .00375 \\
 \hline
 70815894625 \\
 99142252475 \\
 42489536775 \\
 \hline
 5.311192096875
 \end{array}$$

CASE 2.

When one of the factors is finite, and the other a single repeater, multiply by the factor which is finite, carry at 9 in the first figure of the different products, and extend the different products so as to make them continuous before you proceed to the addition; then add as in Addition of Circulating Decimals.

$\begin{array}{r} .7103 \\ .0185 \\ \hline 35516 \\ 568266 \\ 710333 \\ \hline .01314116 \end{array}$	$\begin{array}{r} 40.6 \\ 24.5 \\ \hline 2033 \\ 16266 \\ 81333 \\ \hline 996.33 \end{array}$	$\begin{array}{r} 20.6 \\ 500 \\ \hline 10333.3 \end{array}$
---	---	--

$\begin{array}{r} .9989583 \\ .525 \\ \hline 49947916 \\ 199791666 \\ 4994791666 \\ \hline .524453125 \end{array}$	$\begin{array}{r} 7760.416 \\ 634.375 \\ \hline 38802083 \\ 543229166 \\ 2328125000 \\ 31041666666 \\ 232812500000 \\ 4656250000000 \\ \hline 4923014.322916 \end{array}$
--	---

CASE 3.

When one of the factors repeats, and the other circulates, make the finite factor the multiplier, and the infinite the multiplicand; add 1 to the product of the right hand figure of the circle for the tens on the left hand, then proceed as in finite decimals, observing the same rule as in Addition of Circulates. For every cypher in the multiplier annex the figures of the circle.

$\begin{array}{r} .857142 \\ .795 \\ \hline 4285714 \\ 77142857 \\ 599999999 \\ \hline .681428571 \end{array}$	$\begin{array}{r} .714285 \\ .625 \\ \hline 3571428 \\ 14285714 \\ 428571428 \\ \hline .446428571 \end{array}$
--	--

CASE 4.

When both factors end with repeaters.

EXAMPLES.

$$6.83 \times 7 \div 9 = 5.3148,$$

$$5.6 \times 2.3, \text{ say, } 2.3 - 2 = .3 \times 5.6 \div 9 = .132$$

$$18.6 \times 3 \text{ say, } 18.6 \div 3 = 6.2$$

CASE 5.

When one of the factors is a circulate, and the other a repeater, make the repeater the multiplicand; from the circulating subtract the finite part, and what remains will become a multiplier, the product of which is to be divided by as many nines as the circulate contains figures, the quotient will become the true product; or make the repeater the multiplier, and prepare it as in the last case.

$$\begin{array}{r}
 926.83 \times 4.16 \\
 4.12 \quad 4 \\
 \hline
 185366 \quad 4.12 \\
 926833 \\
 37073333 \\
 \hline
 9)3818.5533 \\
 \hline
 11)4242837 \\
 \hline
 3857.12
 \end{array}$$

$\begin{array}{r} 65.83 \times 5.81 \\ 5.76 \quad 5 \\ \hline 39500 \\ 460833 \\ 3291666 \\ \hline 9)379.2000 \\ \hline 11)421333 \\ \hline 383.03 \end{array}$	or thus, $\begin{array}{r} 5.81 \times 65.83 \\ 592.5 \quad 9 \\ \hline 2909 \quad 592.5 \\ 11636 \\ 523636 \\ 2909090 \\ \hline 9)3447.273 \\ \hline 383.0303 \end{array}$
---	---

CASE 6.

When both the multiplicand and the multiplier end in circulates, reduce the multiplier to a vulgar fraction, and proceed to multiply as directed in Case 3d.—Divide the product by the number of nines contained in the circle of the multiplier, the quotient will be the true product.

$$\begin{array}{r}
 27.54128 \times 7.42 \\
 \underline{7.35} \quad \underline{7} \\
 13770642 \\
 82623855 \\
 1927889978 \\
 \hline
 9)202.4284476 \\
 \hline
 11)224920497 \\
 \hline
 204.47317
 \end{array}$$

$$\begin{array}{r}
 91.857142 \times .36 \\
 \underline{.36} \\
 551142856 \\
 2755714285 \\
 \hline
 9)33.06857142 \\
 \hline
 11)367428571 \\
 \hline
 33.402597
 \end{array}$$

CASE 7.

When a certain number of decimal places are wanted in the product.

RULE. Place the multiplier inverted under the multiplicand in such a manner that the units' place may be directly below that figure in the multiplicand which is designed for the last figure in the product. Proceed to multiply with all the figures of the multiplier according to their place, beginning with that figure in the multiplicand which is above the figure you are multiplying, and carrying what would arise from the figures on the right hand in the different products, so that units may stand above units, and tens above tens as in Addition. When added, the sum will be the approximate, rejecting the last figure as uncertain.

1st, Multiply 9.38645 by 8.2175, and limit the product to 4 decimal places.

$$\begin{array}{r}
 9.38645 \\
 5.7128 \\
 \hline
 750916 \\
 18773 \\
 939 \\
 657 \\
 47 \\
 \hline
 77.1332
 \end{array}
 \quad \text{or,} \quad
 \begin{array}{r}
 9.38645 \\
 8.2175 \\
 \hline
 46 \quad 93225 \\
 657 \quad 0515 \\
 938 \quad 645 \\
 18772 \quad 90 \\
 750916 \quad 0 \\
 \hline
 77.1331 \quad 52875
 \end{array}$$

Multiply 49.63758 by 28.7324, and limit the product to 4 decimal places.

$$\begin{array}{r}
 49.63758 \\
 4237.82 \\
 \hline
 9927516 \\
 3971006 \\
 347463 \\
 14891 \\
 993 \\
 198 \\
 \hline
 1426.2067
 \end{array}$$

CRITERION.

10 acres, 3 roods, 18 poles + 24 ac. 1 rood, 16 poles + 3 roods, 4 poles, 3 yds + 2 feet, 1 inch + 5 acres, 3 roods, 19 poles, 4½ yards + 6 acres, 2 roods, 1 pole, 2½ yards, 11 inches = 12 acres, 12 roods, 5 poles = $r \times 4\frac{1}{2} = p \div 6\frac{1}{2} =$

$q : L674\frac{2}{3} :: 6 \text{ acres, } 2 \text{ roods, } 18 \text{ poles} : q + L183 +$

$L19.345 + .375 \text{ sh} + L.00375 + \frac{1}{4} \text{ guin.} = r - L26.18 = r \times 3.75 = L582.5236505625$

DIVISION OF DECIMALS.

Set down the divisor and dividend as in Division of Integers, and when you have found the quotient, point off as many places in it as with the number of decimal places in the divisor will be equal to the decimal places in the dividend; and should there not be a sufficient number of places in the quotient, the deficiency must be made up by prefixing cyphers to it.

CASE 1.

When the divisor and dividend are finite, proceed as in Division of Integers; when a remainder occurs annex cyphers to the dividend, and carry on the work till you get a sufficient number of figures in the quotient.

$$.345)25725.8910(74567.8$$

$$2415$$

$$.1575$$

$$1380$$

$$.1958$$

$$1725$$

$$.2339$$

$$2070$$

$$.2691$$

$$2415$$

$$.2760$$

$$2760$$

$$....$$

$$16.4375)45716796875(278125$$

$$328750$$

$$1284179$$

$$1150625$$

$$.1335546$$

$$1315000$$

$$205468$$

$$164375$$

$$.410937$$

$$328750$$

$$.821875$$

$$821875$$

$$.....$$

CASE 2.

When the divisor is finite, and the dividend a repeater, proceed as before; but when a remainder occurs, instead of using cyphers to prolong the division, annex the repeater.

$$\begin{array}{r}
 .345)185.69433(538.24 \\
 \underline{1725} \\
 1319 \\
 \underline{1035} \\
 2844 \\
 \underline{2760} \\
 843 \\
 \underline{690} \\
 1533 \\
 \underline{1380} \\
 153
 \end{array}
 \qquad
 \begin{array}{r}
 5.2)21.146(4.06 \\
 \underline{208} \\
 346 \\
 \underline{312} \\
 34
 \end{array}$$

CASE 3.

When the divisor is finite, and the dividend a circulate, proceed as before, and instead of annexing cyphers to prolong the division, add the circulating figures.

$$\begin{array}{r}
 7.42)341.50,09756(46.02439 \\
 \underline{2968} \\
 4470 \\
 \underline{4452} \\
 1809 \\
 \underline{1484} \\
 3257 \\
 \underline{2968} \\
 2895 \\
 \underline{2226} \\
 6696 \\
 \underline{6678} \\
 18
 \end{array}$$

CASE 4.

When the divisor, or both the divisor and dividend repeat, multiply them both by 9, or by any other figure that will exterminate the repeating figures; then proceed as before.

$$\begin{array}{r}
 7.83)21604.3 \\
 \underline{9} \quad \underline{9} \\
 705)1944390(2758 \\
 \underline{1410} \\
 5343 \\
 \underline{4935} \\
 4089 \\
 \underline{3525} \\
 5640 \\
 \underline{5640}
 \end{array}
 \qquad
 \begin{array}{r}
 .3)1928.3 \\
 \underline{9} \quad \underline{9} \\
 3)17355 \\
 \underline{5785}
 \end{array}$$

CASE 5.

When the divisor, or both divisor and dividend circulate, place the finite part of the divisor below the circulating part, and do the same with the dividend.—Subtract for new factors, and proceed as before.

$$\begin{array}{r}
 4.36)534.12612 \\
 \underline{4} \quad \underline{534.126} \\
 432)52878.486(122.4039 \\
 \underline{432} \\
 967 \\
 \underline{864} \\
 1038 \\
 \underline{864} \\
 1744 \\
 \underline{1728} \\
 1686 \\
 \underline{1296} \\
 3904 \\
 \underline{3888} \\
 16
 \end{array}$$

To limit the quotient to a certain number of figures, retain as many places in the left of the divisor as are intended to be in the quotient: point off the rest with all the dividend, except that part from which the first quotient figure is obtained, then omitting the last figure of the divisor for every figure put in the quotient continue the division till the factors be exhausted, the quotient will be approximate, and the last figure uncertain.

<i>At large</i>	
3.25625)86.725625625(26.633	
651250	
2160062	<i>Contracted</i>
1953750	325625)86725625625(26.633
	65125
.2063125	21606
1953750	19537
1093756	2069
976875	1953
1168812	116
976875	97
.1819375	19
	10
	9
625876325)897.654358132(14.3423	
625876325	
2717780331	
2503505300	
2142750313	
1877628975	
2651213382	
2503505300	
1477080820	
1251752650	
2253281700	
1877628975	
375652725	
<i>Contracted.</i>	
625876325)897.654 358132(14.3423	
625876	
271778	
250350	
21428	
18776	
.2652	
2503	
.149	
125	
.24	
18	
.6	

CRITERION.

L.186 $\frac{1}{2}$ +3 $\frac{7}{8}$ sh.+1 $\frac{1}{4}$ d.+ $\frac{1}{2}$ moid.+ $\frac{1}{2}$ joan.+ $\frac{1}{2}$ crown+
 16 $\frac{1}{2}$ half gs.+L .0375+L3.36+L .18763+L14.18+
 sh.236+d.365==L200.6283=r x 6 $\frac{1}{4}$ =p ÷ 8 $\frac{1}{2}$ =
 L10.76125968

CROSS MULTIPLICATION

RULE.

First multiply the different denominations of the length by the number of feet in the breadth; take parts, as in Practice, for the inches and parts; then add the different products,—or multiply by the inches, carrying by 12. Set each product one place nearer to the right hand, then multiply by parts in the same way, carrying by 12, and remove each product another place to the right hand.—Prove them by decimals.

f	in		f	in	
60	4		12.8		12.6
8	10		9.6		9.6
482	8		114 0		114.
50	3 4		6 4		6.3
532	11 4		120 4		120.3
		532.94			

f	in		f	in	
120	10		90	11	
4	9		3	7	
483	4		272	9	
90	7 6		53	0 5	
573	11 6		325	9 5	

573.9583

6 $\frac{1}{2}$) 90.916
 1 $\frac{1}{8}$) 3.7

272.75
 45.45833
 7.75638

325.78472

MENSURATION.

1ft, What is the price of a piece of wood, 11 feet, 2 inches long, 1 foot, 10 inches broad, at 6s. per foot?

11 2 or 11.16
1 10 1 10

11. 2 11.166
9. 3. 8 5.583
3.722

20. 5. 8 at 6s. }
= L6 2 10 }

$$20.472 \times 6 \div 20 = 6.1416 =$$

L.6 2 10

2d, What cost a marble slab, 6 feet, 10 inches long, 4 feet, 5 inches broad, at 5s. 3d. per foot?

Ans. L.7 18 5 $\frac{1}{4}$

3d, There is a house with 3 tier of windows, 3 in a tier, the height of the first tier is 7 feet, 6 inches; the second 6 feet, 6 inches; the third 5 feet, 2 inches, and the breadth of each 3 feet, 10 inches, what will the glazing cost at 1s. 4d. per foot?

Ans. L.14 13 10 $\frac{1}{2}$ 7 $\frac{1}{2}$

Note, Glazing, and Masons' flat work are taken by the foot.

4th, What cost the paving of a court yard at 5d. per yard, the length being 60 feet, 6 inches, the breadth 56 feet, 9 inches?

Ans. L.7 18 11 $\frac{1}{4}$

Note, The dimensions of paving and painting are taken by the yard square, or 9 feet.

5th, A room is 96 feet, 6 inches about, and 10 feet, 2 inches high, what will the painting of it come to at 2s. 6d. per yard?

Ans. L.13 12 6 $\frac{1}{2}$

6th, A piece of wainscoting is 10 feet, 5 inches long, and 7 feet, 6 inches broad, what will it come to at 7s. 10d. per yard?

Ans. L.3 7 11 $\frac{1}{4}$

7th, If a house measures within the walls 60 feet, 10 inches in length, and 44 feet, 5 inches in breadth, and the roof be of a true pitch, or the rafters be $\frac{1}{2}$ of the breadth of the building, what will the roofing come to at 12s. 6d. per square?

Ans. L.28 9 1

Note, To the product of the breadth and length add the half of it, after which divide by 100, for the whole measurement.

Partitioning, flooring, tiling, &c. are measured by the square of a 100 feet.

It is usual in measuring tile roofs to allow double measure at the projections over the eaves.

8th, What will the tiling of a barn cost at L.1 2 6 per square, the length being 36 feet, 10 inches, and the breadth 25 feet, 6 inches on the flat; eave boards projecting 18 inches on each side?

Ans. L.16 15 7 $\frac{1}{2}$

9th, How many square rods are there in a wall 56 feet, 6 inches long, 15 feet, 10 inches high, 2 $\frac{1}{2}$ bricks thick?

Ans. 5.4764 rods.

Note, Brick work is measured by the rod of 16 $\frac{1}{2}$ feet, whose square is 272.25.

Bricklayers always value their work at the rate of a brick

and a half thick, and if the wall is more or less, it must be reduced to that thickness.

10th, In a plank 20 feet long, and 10 inches broad, how many square feet?

Ans. 16 feet, 8 inches.

Note, To measure board and timber, multiply the length in feet by the breadth in inches, divide the product by 12, and the quote is square feet, every remainder being one twelfth of a square foot.

11th, In a plank 20 feet, 6 inches long, and 20 inches broad, how many square feet?

Ans. 34 feet, 2 in.

12th, If a plank be 6 inches broad, how many inches will make a foot square?

Ans. 24 inches.

Note, If the two ends of a plank differ in breadth, add them and take the half of their sum for a mean breadth.

13th, In a piece of squared timber 20 feet long, the side of the square base being 13 inches, how many solid feet?

$13 \times 13 \times 20 \div 144 =$ *Ans.* 23 feet, 5 in. 8 parts

14th, In a piece of squared timber 14 feet long, the side of the square base being 11 inches, how many solid feet?

Ans. by decimals, 11.7638 feet

Note, Multiply the area of the base by the length, the product is the solid content.

15th, In a piece of square timber 32 inches broad, and 20 inches thick, and 15 feet, 6 inches long, how many solid feet?

Ans. decimally 68.8, and common way 68 feet, 10 in. 8 parts.

16th, In a piece of squared timber 15 feet long, the side of the square base at the greater end is 30 inches, and at the lesser end 12 inches, how many feet of timber are there in the log?

Ans. 45.9375 feet

17th, Required the solid content of a tree 16 feet long, and 12 inches the side of the square.

Ans. 16 feet.

18th, If a piece of timber be 12 feet long, 13 inches broad, and 8 deep, what is the solid content thereof?

Ans. 8 feet, 8 inches.

19th, What is the solid content of a piece of timber, 18 feet, 6 inches long, 16 $\frac{1}{2}$ inches broad, and 13 $\frac{1}{2}$ inches deep?

Ans. 28.6171875

Note, The usual way to measure round timber is to gird the tree in the middle with a small cord, then $\frac{1}{2}$ of the girt is considered as the side of the square. But though this method has been often exposed as erroneous, it is still used, and purchasers will adopt no other, on account of it's being short and simple — The following rule, however, is much nearer the truth, and very little different as to it's shortness and simplicity. Take $\frac{1}{2}$ of the girt, and square it, after which multiply it by twice the length, for the solid contents.

20th, How much timber in a round tree 40 feet long, and the girt 4 feet, 4 inches?

$$\begin{array}{r}
 \frac{1}{4} \text{ of } 4 \quad 4 = 1 \quad 1 \\
 \hline
 1 \quad 1 \\
 \hline
 1 \quad 1 \\
 \hline
 1 \quad 1 \\
 \hline
 1 \quad 2 \quad 1 \times 40 = 46 \quad 11 \quad 4 \text{ Ans. } 169 \\
 \hline
 40 \\
 \hline
 144) 6760 (46.94 \text{ An. } \\
 \hline
 576 \\
 \hline
 1000 \\
 \hline
 864 \\
 \hline
 136.00
 \end{array}$$

20th, What is the solid content of a round tree 20 feet long, and girt in the middle 13 feet, 4 inches?

Ans. 222 feet, 2 in. 8 parts

22d, How many solid feet in a round tree 14 feet long, and the girts 20, 18 and 12 inches? Ans. 1.685 feet

Note, Divide the sum of all the girts by the number of girts, for the mean girt, then proceed as before.

23d, A tree 24 feet, 6 inches in length, is divided into two parts, each 12 feet, 3 inches, the middle girt of one of the parts being 5 feet, 8 inches, and of the other $3\frac{1}{2}$ feet, how many feet of timber are in that tree?

Ans. 33 feet, 11 in. 6 parts

Note, Find the contents as before of the different lengths, and their sum is the answer.

DECIMAL PRACTICE.

893 at 6s. 8d.	Ans. 297.6	=	L. 297 13 4
949 at 3s. 4d.	158.16	=	158 3 4
6925 at 1s. 8d.	577.083	=	577 1 8
557 at 4d.	9.283	=	9 5 8
769 at 3d.	9.6125	=	9 12 3
246 at $1\frac{1}{2}$ d.	1.5375	=	1 10 9
328 at $4\frac{1}{2}$ d.	6.15	=	6 3 0
822 at $3\frac{1}{2}$ d.	12.84375	=	12 16 $10\frac{1}{2}$
368 at $2\frac{1}{4}$ d.	3.450	=	3 9 0
747 at 4s. $8\frac{1}{2}$ d.	175.85625	=	175 17 $1\frac{1}{2}$
842 at 3s. 11d.	164.88826	=	164 17 9
756 at 16s. 10d. $\frac{6}{10}$	638.190	=	638 3 $9\frac{1}{2}$
45 cwt. 2 qrs. 16 lib. at L. 2 18 6 per cwt.			L. 133.505357142
1002 $\frac{3}{4}$ at L. 3 19 $11\frac{1}{4}$	L. 4009.62	=	L. 4009 12 $5\frac{1}{4}$
149 $\frac{7}{8}$ at 18s. $6\frac{1}{8}$ d.	L. 138.5980		

For more examples, see Practice common way.

SINGLE RULE OF THREE IN DECIMALS.

1st, If (a) $30\frac{1}{2}$ yards of cloth cost (b) L. 7 10, what will (c) $45\frac{1}{2}$ cost at the same rate?

If a : b :: c : L. 11.127

2d, When I borrow of my friend (a) L. 120 for (b) 6 $\frac{1}{2}$ months, what sum should I lend him (c) 15 months, to requite the favour?

If b : a :: c : L. 27.6923

3d, If (a) 40 men build a house in (b) $120\frac{1}{2}$ days, how long will (c) 12 men take to build the same?

If c : b :: a : 401.25

4th, When I buy broad cloth at 14s. 6d. per Scotch ell, and sell it at the same price per yard, what do I gain per cent? Ans. $3\frac{1}{2}$

5th, When I travelled (a) $12\frac{1}{2}$ miles every day, I made a journey of 600 miles in (b) 20 days, how long would this journey take me when I travelled only (c) 10 hours every day?

If c : b :: a : 25 days Ans.

6th, If a tailor can make a coat and vest with (a) $4\frac{1}{2}$ yards of cloth, which is (b) $\frac{3}{4}$ of a yard broad, how many yards will he require to make the same when the cloth is $1\frac{1}{2}$ yards broad?

If c : a :: b : 2.25 yards Ans.

7th, What quantity of shalloon that is (a) $\frac{1}{4}$ of a yard wide will line (b) $6\frac{1}{2}$ yards of cloth, that is (c) $1\frac{1}{2}$ yards wide?

If a : b :: c : 13 Ans.

8th, How many yards of paper $\frac{1}{4}$ of a yard wide will be sufficient to hang a room which is 220 feet round, and $10\frac{1}{2}$ feet in height? Ans. 342.2

9th, There is a floor 40 feet, 9 inches long, and 28 feet, 10 inches wide, to be laid with deals uniformly, 12 feet, 6 inches, by $9\frac{1}{2}$ inches, how many will it require, allowing the odd half inch in breadth to go for seaming?

Ans. 125.328

10th, There is a room 30 feet, 9 inches, by 22 feet, 6 inches, whose height is 12 feet, 10 inches, to be lined with paper, $\frac{1}{4}$ yard wide, how many yards will it require?

Ans. 202.481

11th, A gentleman hired a servant for a year, agreeing that every day he wrought he should receive (a) 1s. and every day he was idle he should forfeit (b) 15d.; now at the (c) year's end, neither master nor servant was indebted, how many days did he work, and how many was he idle?

If b + a : a :: c : $162\frac{2}{3}$ idle days

If a + b : b :: c : $202\frac{2}{3}$ working days

365 proof

CRITERION.

$$10\frac{7}{8} \text{ dwt.} + 1\frac{1}{4} \text{ lib.} + 87.65 \text{ gr.} + 6\frac{1}{8} \text{ lib.} + \frac{1}{4} \text{ of } \frac{1}{8} \text{ lib.} = s$$

$\frac{6}{7}$ of $\frac{4}{5}$ of $\frac{1}{2}$ oz. = $r \times 8\frac{1}{2} = p \div 3\frac{1}{2} = q : L.27 : : 15\frac{1}{2}$ lib.
: L.1742

DOUBLE RULE OF THREE IN DECIMALS

Teaches how to work with five, seven, &c. terms, in order to find a sixth, eighth term or answer, from which it is often styled the Rule of Five, the Rule of Seven, &c. — As in the Single Rule of Three, so is it here—the middle term and the answer are of the same kind, and the rest of the terms are stated in pairs of the same name.

To state any question in this rule, take that term which is of the same kind with the answer, and set it down with four points after it, and two before it: then consider from the nature of the question, whether the answer is to be greater or less than your middle term; then take any pair of the remaining terms, and place the lesser on the left hand, and the greater on the right hand, if the answer is to be greater than your middle term; but if the answer be less than your middle term, then place the lesser on the right hand, and the greater on the left hand, and so on with every other pair of terms which are of the same kind. Then bring each pair of terms to the same name with each other, and the middle term to the lowest denomination given in it.

Multiply the middle term into all the terms on the right hand for a dividend, and all the terms on the left hand for a divisor, which will quote the answer in the same denomination that the middle term was reduced to, supposing it to have consisted of different denominations.

EXAMPLES.

1st, If (a) L.100 in (b) 12 months gain (c) L.5 interest, what interest will (d) L.698 gain in (e) 1 year and 9 months?

$m \quad L \quad L \quad L \quad m$

If $b : a : c :: d : e : L.61 \quad 1 \quad 6 \quad Ans.$

2d, If (a) 47 men build (b) 40 roods of wall in (c) 14 days, how many roods will (d) 94 men build in (e) 20 days?

If $a : c : b :: e : d : 114\frac{1}{2}\frac{1}{4}$ roods *Ans.*

3d, If (a) L.400 gain (b) L.16 10 in (c) 14 months, how much will (d) L.1080 gain in (e) 10 months?

If $c : a : b :: d : e : L.31 \quad 16 \quad 5\frac{1}{4} \quad Ans.$

4th, If a man can travel (a) 80 miles in (b) 3 days of (c) 12 hours each, how many miles will he travel in (d) 12 days of (e) 9 hours each?

If $c : b : a :: d : e : 240$ miles *Ans.*

5th, If (a) 42 men mow (b) 36 acres of grass in (c) 8 days, how many acres will (d) 90 men mow in (e) 14 days?

If $c : a : b :: d : e : 135$ acres *Ans.*

6th, What is the interest of (a) L.899 for (b) 145 days at (c) 5 per (d) cent. per (e) annum?

If $e : d : c :: a : b : L.17.856 \quad Ans.$

7th, If (a) 20 men eat (b) 18 shillings worth of bread in (c) 2 days, when wheat is (d) 20 shillings per boll, what va-

lue of bread will (e) 58 men eat in (f) 26 days, when wheat is (g) 16 shillings per boll?

If $d : c : a : b :: e : f : g : L.27 \quad 2 \quad 10\frac{1}{4} \quad Ans.$

8th, If (a) 12 men receive (b) L.7 14 3 for (c) 6 days' work, how much money will pay (d) 63 men for (e) 10 days, at the same rate?

If $c : a : b :: d : e : L.67 \quad 9 \quad 8\frac{1}{4} \quad Ans.$

9th, If the interest of (a) L.160 for (b) 35 weeks be (c) L.4 10, what is the rate per (d) cent. per (e) annum?

If $b : a : c :: d : e : 4\frac{1}{2}\frac{1}{4}$ per cent. *Ans.*

10th, If 18 men build a wall 40 feet long, 3 feet thick, and 16 feet high in 12 days, how many men must be employed to build a wall 360 feet long, 8 feet thick, and 10 feet high in 60 days?

Ans. 54 men.

11th, If 24 men dig a ditch 724 yards long, 7 feet deep, 3 feet wide at the bottom, and 5 feet wide at the top in 236 days, 13 hours and 24 minutes long, in how many days, 12 hours and 36 minutes long, will 16 men dig a ditch 675 yards long, 9 feet deep, 5 feet wide at the bottom, and 7 feet wide at the top?

Ans. 1052.989 days.

12th, If 14 men build a wall 80 feet long and 4 feet thick, and 22 feet in height in 46 days, working 12 hours per day, what length of wall $2\frac{1}{2}$ feet thick, and 16 feet high will 12 men build in 24 days, working 10 hours per day?

Ans. 65.590 feet long.

BARTER

Is a sort of trade carried on by many, particularly in places where money is scarce. The calculations are made out by the most answerable of the preceding rules.

CASE I.

When any quantity, with it's price are given, to find how much of another quantity of a certain value may be given for it.

RULE, Find the value of the quantity given in the question, then find how much of the other that sum will purchase.

EXAMPLES.

1st, How many (a) lib. of sugar at (b) 7d. may be given for (c) 30 hats at (d) 12s. 6d. each?

$c \text{ at } d = L.18 \quad 15$

$b : a :: L.18 \quad 15 : \text{lib. } 642\frac{1}{2} \quad Ans.$

2d, How much sugar at (a) L.2 18 6 per (b) cwt. may be given for (c) 178 lib. cheese at (d) 7s. 6d. per (e) stone, allowing 16 lib to the stone?

$\text{lib. } d \quad \text{lib. } d$

If $e : d :: c : q$

$d \text{ cwt } d \text{ cwt gr } \text{lib.}$

If $a : b :: q : 1 \quad 1 \quad 19\frac{1}{4} \quad Ans.$

3d, How much cotton at (a) 1s. 10d. per (b) lib, may be given for (c) $\frac{1}{2}$ cwt. sugar at (d) $6\frac{1}{2}$ d. per (e) lib?

$$\begin{array}{ccccc} \text{lib} & f & \text{lib} & f & \\ \text{If } e : d :: c : q & & & & \end{array}$$

$$\begin{array}{ccccc} f & \text{lib} & f & \text{lib} & \text{oz} \\ \text{If } a : b :: q : 16 & 8\frac{3}{4} & \text{Ans.} & & \end{array}$$

4th, How much rum at (a) 15s. 6d. per (b) gallon, would you give for (c) 500 yards linen at (d) 3s. 6d. per (e) yard?

$$\begin{array}{ccccc} y & d & y & d & \\ \text{If } e : d :: c : q & & & & \\ d & \text{gal} & d & & \end{array}$$

$$\text{If } a : b :: q : 112\frac{2}{3} \text{ gallons Ans.}$$

5th, How many stones of candle at (a) 11s. per (b) stone, would you give for a last of herrings at (c) 26s. 7d. per (d) barrel?

$$\begin{array}{ccccc} b & d & b & s & \\ \text{If } d : c :: 12 : q & & & & \\ s & \text{stone} & s & & \end{array}$$

$$\text{If } a : b :: q : 29 \text{ stone Ans.}$$

CASE 2.

To prevent imposition in this species of trade, the following rule may be useful.

RULE, As the real value of the one, is to the value of the other, so is the advanced price of the one, to the advanced price of the other.

EXAMPLES.

1st, A has sugar at (a) 6d. per (b) lib. but in barter he wants (c) 9d.; B has cloth at his ordinary selling price of (d) 18s. 9d. per (e) yard, how much of his cloth ought he to give at a price advanced in proportion for (f) 16 cwt. of A's sugar?

$$\begin{array}{ccccc} d & d & d & d & \\ \text{If } a : c :: d : q & \text{1st bartering price of } B's \text{ cloth per yard} & & & \\ \text{If } b : c :: f : q & \text{2d} & & & \text{of } A's \text{ sugar} \end{array}$$

$$q \text{ 1st} : e :: q \text{ 2d} : 47\frac{1061}{1150} \text{ yards}$$

2d, A has hops worth (a) 10d. per lib. which he charged at (b) 16d. per (c) lib.; B apprized of this, would raise his malt (worth (d) 20s. per (e) boll) in proportion, how much malt will compensate for (f) $20\frac{1}{2}$ cwt. hops?

$$\begin{array}{ccccc} d & s & d & s & \text{lib } d \text{ lib } d \\ \text{If } a : d :: b : q \text{ 1st} & & \text{If } c : b :: f : q \text{ 2d} & & \end{array}$$

$$\begin{array}{ccccc} s & b & d & & \\ \text{If } q \text{ 1st} : e :: q \text{ 2d} : 95\frac{116}{115} \text{ bolls Ans.} & & & & \end{array}$$

3d, What must A raise his broad cloth to when it is worth (a) 17s. 9d. per yard, to be equal with B, who rates his linen at (b) 4s. 6d. which is worth only (c) 3s. 9d?

$$\begin{array}{ccccc} d & d & d & & \\ \text{If } c : b :: a : L.1 & 1 & 3\frac{1}{2} & \text{Ans.} & \end{array}$$

4th, A has broad cloth worth only (a) 18s. 6d. per (b) yard, but which he reckons in barter worth (c) L.1 1; B

has wool worth (d) 1s. per (e) lib. how much of the wool will B give for (f) 126 yards of A's cloth, advancing it's price in the same proportion?

$$\text{If } a : c :: d : q \text{ 1st}$$

$$q \text{ 1st} : e :: f \times c : 2352 \text{ lbs. Ans.}$$

PROFIT AND LOSS.

This Rule teaches how to state the price of any commodity, so as to gain or lose so much per cent. upon the whole or any part of it.

CASE 1.

When there is a certain profit wanted on any quantity of a commodity, add the profit wanted to the first cost, and divide the price by the quantity, the quotient is the selling price per yard, per lib. &c.

EXAMPLES.

1st, A draper bought (a) 120 yards of broad cloth for (b) L.90 how must he sell it per (c) yard, to gain (d) L.12 8 3 on the whole?

$$b + d = s$$

$$\begin{array}{ccccc} y & d & y & & \\ \text{If } a : s :: c : 17s. 0\frac{1}{2}d. \text{ Ans.} & & & & \end{array}$$

2d, Bought (a) 100 gallons of rum for (b) L.63, paid for duty (c) L.10 4 8, and for charges (d) L.1 10 4; how may I sell it per (e) gallon, to clear (f) L.8 1 6 by the bargain?

$$b + c + d + f = s$$

$$\begin{array}{ccccc} g & L & g & & \\ \text{If } a : s :: e : L.0 16 6\frac{1}{4} \text{ Ans.} & & & & \end{array}$$

3d, Bought (a) 30 cwt. of barley for (b) L.18, paid (c) 15s. 6d. for carriage, &c. at what price must I sell it per (d) lib. to gain (e) L.2 6 upon the whole?

$$\begin{array}{ccccc} b + c + e = s & & & & \\ \text{lib } d & \text{lib} & & & \end{array}$$

$$\text{If } a : s :: d : L.0 0 1\frac{1}{2} \text{ Ans.}$$

4th, Bought (a) 14 cwt. of sugar at (b) L.4 5 per (c) cwt. which I sell out again at (d) $10\frac{1}{2}$ d. per (e) lib. what is the profit on the whole?

$$\begin{array}{ccccc} \text{cwt } L & \text{cwt } L & & & \\ \text{If } c : b :: a : q & & & & \end{array}$$

$$\begin{array}{ccccc} \text{lib } d & \text{lib } L & L & & \\ \text{If } e : d :: a : p - q = L.9. 2 \text{ profit} & & & & \end{array}$$

CASE 2.

When the first cost and selling price per yard, &c. are given, to find the profit or loss on a certain quantity,—from the higher price take the lower, then multiply the difference by the given quantity. The product is the profit or loss upon the whole.

EXAMPLES.

1st, Bought (a) 16 cwt. 2 qrs. of sugar at (b) 7½d. per lib. and sold it at (c) 10d. per lib. what do I gain supposing I pay (d) 15s. for incidental charges?

lib.

a at $r = p - d = L. 18$ 10 gain.

2d, Bought (a) 345 lbs of tea at (b) 3s. 9d. per lib. and sold it in retail at (c) 3d. per ounce, what do I gain, supposing I pay (d) L. 2 10 of duty?

$c \times 16 - b = r \times a = p - d = L. 1$ 16 3 gain.

3d, Bought cloth at (a) 9s. 8d. and sold it at (b) 10s. 6d. per yard, what do I gain on (c) 30 pieces, each (d) 20 yards?

$b - a \times c \times d = L. 25$ gain.

CASE 3.

When the prime cost and rate of selling per yard, &c. are given, to know the profit or loss per cent. from the higher price subtract the lower; then say as the first cost is to its profit or loss, so is 100 to the profit or loss per cent.

EXAMPLES.

1st, Bought cloth at (a) 12s. 10d. per yard, and sold it at (b) 13s. 4d. what was the gain per (c) cent?

As $a : b - a :: c : 3\frac{2}{3}$ per cent. *Ans.*

2d, Bought tea at (a) 5s. 9d. per lib. but getting damaged, I was obliged to sell it at (b) 4s. 6d. what was the loss per (c) cent?

$a - b = r$ as $a : r :: c : 21\frac{1}{3}$ per cent. *Ans.*

3d, Bought (a) 16 cwt. 2 qrs. of sugar at (b) 7½d. per (c) lib. and sold it at (d) 10d. what did I gain per (e) cent. and how much upon the whole?

a lib. at $b = p$ a = lib. at $d - b = r$

As $p : e :: r : 33\frac{1}{3}$ gain per cent.

Gain upon the whole, L. 19. 5

4th, Bought yarn at (a) 2s. 6d. per spynle, and sold it at (b) 2s. 4½d. what do I lose per (c) cent. and on (d) 5000 spynles?

$a - b = r$ As $a : r :: c : 5\frac{1}{2}$ per cent loss.

d at $r = L. 36$ 9 2 loss on 5000 spynles.

CASE 4.

When the rate per cent. is given of profit or loss, say, as 100 is to 100 with its profit or loss added or subtracted, so is the buying price to the selling price.

EXAMPLES.

1st, Bought cloth at (a) 5s. 6d. per yard, upon which I would gain (b) 10½ per (c) cent. how should I rate per yard?

If $c : a :: b + c : 6s. 0\frac{1}{2}d. \frac{1}{2}$ *Ans.*

2d, Bought tea at (a) 5s. 9d. per lib. but getting dama-

ged, I am obliged to lose (b) 21½ per (c) cent. what must I sell it at to save myself?

If $a : a :: c - b : 4s. 6d. \text{ per lib. } \textit{Ans.}$

3d, Bought shoes at (a) 4s. 7d. per pair, what must I sell them at per (b) dozen, to gain (c) 15 per (d) cent?

$d : a :: d + c : q \times b = L. 3$ 3 3 *Ans.*

CASE 5.

When the rate per cent. and the price are given, to find an advanced price, and the rate per cent. on it, say, as the lowest price is to the highest, so is 100 added to the given rate, to 100 added to the rate required.

EXAMPLES.

1st, Bought beef at (a) 8s. 6d. per stone, by which I cleared (b) 10 per (c) cent. The merchant who bought it got (d) 9s. 6d. what was his profit?

$d : d :: d : b + c : q - c = 22\frac{1}{3}$ *Ans.*

2d, Sold butter at (a) 58s. per cwt. by which I cleared (b) 10½ per (c) cent. what would I clear per cent. should it rise to (d) L. 3 per cwt?

If $a : d :: b + c : p - c = 14\frac{2}{3}$ *Ans.*

CASE 6.

To find the prime cost, when the selling price and gain or loss per cent. are given, say, as 100 with its gain added, or its loss subtracted is to 100, so is the prime cost to the selling price.

EXAMPLES.

1st, Sold brandy at (a) 16s. per gallon, by which I gained (b) 12½ per (c) cent. what was the prime cost?

If $b + c : a :: c : 14s. 2\frac{1}{2}d. \frac{1}{2}$ *Ans.*

2d, Sold tobacco at (a) 45s. per cwt. by which I cleared (b) 25 per (c) cent. required the prime cost?

If $b + c : a :: c : 36s. \textit{Ans.}$

3d, Sold candles at (a) 9s. 7d. per stone, by which I lost (b) 5½ per (c) cent. required the prime cost?

If $c - b : a :: c : 10s. 1\frac{1}{2}d. \frac{1}{3}$ *Ans.*

PARTNERSHIP

Teaches how to divide the gain or loss of merchants, in proportion to their advanced stocks.

CASE 1.

When all the partners have advanced equal stocks, divide the gain or loss by the number of partners, the quotient is the answer.

EXAMPLES.

1st, (a) Three persons cleared in the course of business (b) L. 3000, what is each partner's share?

$b \div a = L. 1000$ *Ans.*

2d, *A*, *B*, *C*, and *D* being equally concerned in an adventure to the West Indies, met with a loss of (e) L.1300, what does each of them lose, allowing (f) *C* L.120 for transacting the business?

$$e + f \div A + B + C + D = 355 - f = 235$$

A, *B* and *D*'s loss is L.235, and *C*'s L.235

3d, *A*, *B*, *C*, and *D* are equally concerned in an adventure to America, in which they profited L.5680, how much is that for each, allowing *D* L.200 for transacting the business?

A, *B*, and *C*'s share is L.1370

D's share is L.1570

CASE 2.

When the capitals are divided into a certain number of shares, make the gain or loss the dividend, the number of shares the divisor, multiply the quotient by the number of shares held by each partner, the products are the respective answers.

EXAMPLES.

1st, The stock of a commercial company is (a) L.10000, required *A*'s share in it who holds (b) three parts, the company consisting of (c) 10 shares?

$$a \div c \times b = L.3000 \text{ } A\text{'s share.}$$

2d, A copartnership of (a) 36 shares, have a capital of (b) L.12000, required *A*'s stock who holds (c) 7 shares?

$$b \div a \times c = L.2333 \text{ } 6 \text{ } 8 \text{ } A\text{'s stock.}$$

CASE 3.

When the shares of the partners are unequal, add them all together, and say, as the whole capital is to the whole gain, so is each partner's stock to his share of the gain.

EXAMPLES.

1st, Three persons, *A*, *B*, and *C*, partners in business, gain (a) L.286, *A* put in (b) L.368, *B* put in (c) L.496, *C* put in (d) L.355, required their respective shares of the gain?

$$\begin{array}{rcl} b + c + d = s : a :: b : L. & 86 & 6 \text{ } 9\frac{1}{2} \text{ } 1\frac{1}{2} \\ & :: c : & 116 \text{ } 7 \text{ } 4\frac{1}{2} \text{ } 1\frac{1}{2} \\ & :: d : & 83 \text{ } 5 \text{ } 9\frac{1}{2} \text{ } 1\frac{1}{2} \end{array}$$

$$L.286 \text{ } 0 \text{ } 0 \text{ proof}$$

2d, Three men *A*, *B*, and *C*, entered into trade with a capital of L.3500, of which *A* paid in L.1000, *B* L.960, and *C* the rest. In the course of a year's business they cleared L.700, what was *C*'s stock, and each person's share of the gain?

C's stock L.1540

A's share L.200, *B*'s L.192, and *C*'s L.308

3d, Four men, *A*, *B*, *C*, and *D* in course of trade, lost to the amount of L.500, their whole stock was L.3000, whereof *A* put in L.1800, *B* L.800, *C* and *D* an equal share of the rest, what is each partner's loss?

$$\begin{array}{rcl} A\text{'s loss} & L. & 300 \text{ } 0 \text{ } 0 \\ B\text{'s} & & 133 \text{ } 6 \text{ } 8 \\ C\text{'s} & & 33 \text{ } 6 \text{ } 8 \\ D\text{'s} & & 33 \text{ } 6 \text{ } 8 \end{array}$$

4th, (a) Ten sergeants, (b) twenty corporals, and (c) thirty privates, spent in one night at a public house, (d) L.5 6 8, and at settling the reckoning it was agreed among them that for every (e) shilling a sergeant paid, a corporal paid (f) 8d. and a private (g) 6d. what did each person pay of the bill?

$$a \times e = 1st \text{ p}$$

$$b \times f = 2d \text{ p}$$

$$c \times g = 3d \text{ p}$$

$$s : d :: 1st \text{ p} - q \div a = L.0 \text{ } 2 \text{ } 9\frac{1}{2} \text{ } 1\frac{1}{2} \text{ each sergeant's share}$$

$$s : d :: 2d \text{ p} : q \div b = L.0 \text{ } 1 \text{ } 10\frac{1}{2} \text{ } 1\frac{1}{2} \text{ each corporal's share}$$

$$s : d :: 3d \text{ p} : q \div c = L.0 \text{ } 1 \text{ } 4\frac{1}{2} \text{ } 1\frac{1}{2} \text{ each private's share}$$

5th, A father bequeathed his estate in the following manner: to one of his sons he left $\frac{1}{4}$ and $\frac{1}{4}$ of what remains to another, and the rest to his widow during her life. The legacies of the children differed L.257 3 4: Quere, What was left to the widow?

$$1 - \frac{1}{4} = \frac{3}{4} \text{ the residue after the first share}$$

$$\frac{1}{4} \text{ of } \frac{3}{4} = \frac{3}{16} \text{ the second son's share}$$

$$\frac{1}{4} - \frac{3}{16} = \frac{1}{16} \text{ the difference of the sons' shares}$$

$$83 - 34 = 49 \text{ of } \frac{1}{16} = \frac{49}{16}$$

$$As 1156 : 2401 :: 257.16 : L.534.1324 \text{ Ans.}$$

CASE 4.

When each partner's share is to be proportioned to his stock in company, multiply his stock into the time, then add all the products, and say as their sum is to the total gain, loss, or common dividend, so is the product of each partner's time and stock multiplied into one another to their respective shares; or find the gain or loss on L.100, or L.1, and compute the rest by Practice.

EXAMPLES.

1st, *A* and *B* become partners in trade, *A* advances (a) L.300 for (b) 5 months, and *B* advances (c) L.600 for (d) 4 months, at the end of which time they cleared (e) L.150, what is each partner's share of the gain?

$$a \times b \times c \times d = p$$

$$\text{If } p : e :: a \times b : L.57 \text{ } 13 \text{ } 10 \text{ } 1\frac{1}{2} \text{ } A\text{'s share.}$$

$$\text{If } p : e :: c \times d : L.92 \text{ } 6 \text{ } 13 \text{ } 1\frac{1}{2} \text{ } B\text{'s share.}$$

$$\text{Proof } L.150 \text{ } 0 \text{ } 0$$

2d, *A*, *B*, and *C* farm a piece of ground at the rate of (a) L.80 per annum, upon which *A* put (b) 16 cows for (c) 2 months, and *B* (d) 20 cows for (e) 5 months, and *C* (f) 15 cows for (g) 3 months, what ought each partner to pay of the rent?

$$b \times c + d \times e + f \times g = p$$

$$\text{If } p : a :: b \times c : L.13 \text{ } 17 \text{ } 6 \text{ } 1\frac{1}{2} \text{ } A\text{'s part}$$

If $p : a :: d \times e : L.43 \ 7 \ 2\frac{1}{2} \frac{6}{1000}$ B's part
 If $p : a :: f \times e : L.22 \ 15 \ 3\frac{1}{2} \frac{1}{1000}$ C's part.

Proof L.80 0 0

3d, A privateer took a prize valued at (a) L.8000, which is to be shared among the crew in proportion to their wages, and the time they had been on board. Now the officers and midshipmen had continued with the ship (b) 3 months, the common sailors only (c) 2 months; the pay of the officers was (d) L.5 per month, the midshipmen (e) L.3 per month, and the common sailors (f) L.2 per month; moreover, there were (g) 5 officers, (h) 9 midshipmen, and (i) 140 sailors, what was each person's share of the prize?

$$b \times d \times g + b \times e \times h + c \times f \times i = p$$

If $p : a :: b \times d \times g : L.837 \ 19 \ 9\frac{1}{2} \frac{1}{1000} \div 5 = L.167$
 11 11 11 each of the officer's share

If $p : a :: b \times e \times h : L.905 \ 0 \ 6\frac{1}{2} \frac{1}{1000} \div 9 = L.100$
 11 2 each of the midshipmen's share

If $p : a :: c \times f \times i : L.6256 \ 19 \ 7\frac{1}{2} \frac{6}{1000} \div 140 = L.44$
 13 10 10 each of the sailor's share

4th, L, M, and N, in partnership, have a capital of (a) L.3510. L's share continued in trade (b) 3 months, M's (c) 4 months, N's (d) 6 months, in the course of which time they gained (e) L.251, which was to be divided after this manner, viz. $\frac{1}{3}$ of L's share to be equal to (g) $\frac{1}{4}$ of M's, and (h) $\frac{1}{6}$ of N's share to be equal to (i) $\frac{1}{6}$ of N's, what profit did each partner take, and what capital did each advance?

$2+3+4=s : e :: 2 : L.55 \ 15 \ 6\frac{1}{2} \frac{6}{1000}$
 L's gain $\times b =$ } L.167 6 8 or L
 $s : e :: 3 : L.83 \ 13 \ 4$ }
 M's gain $\times c =$ } 334 13 4 or M
 $s : e :: 4 : L.111 \ 11 \ 1\frac{1}{2} \frac{1}{1000}$ }
 N's gain $\times d =$ } 669 6 8 or N

Proof, L.251 0 0 ors. 117 6 8

If $s : l :: a : L.501 \ 8 \ 6\frac{1}{2} \frac{1}{1000}$ L's stock

$s : m :: a : 1002 \ 17 \ 1\frac{1}{2} \frac{1}{1000}$ M's do

$s : n :: a : 2005 \ 14 \ 3\frac{1}{2} \frac{1}{1000}$ N's do

L.3510 0 0 Proof

5th, Three persons, A, B, and C, enter into company, A advances upon the first of May (a) L.80, B advances on the 1st of July (b) 180 yards of corduroy, C advances on the 1st Sept. (c) 310 dollars; on the first of March following the copartnership dissolved, when their profits were divided, of which A and B got (d) L.690, B and C received (e) L.560, and C and A (f) L.490. I demand each partner's profit, the price of B's corduroy per yard, and the value of a dollar.

$$d+e+f \div 2 = q$$

$$q-d = C's \text{ gain } \div 6 \text{ months} = 30.$$

$$q-e = A's \text{ gain } \div 10 \text{ do} = 31.$$

$$q-f = B's \text{ gain } \div 8 \text{ do} = 47.5$$

If $31 : 80 :: 47.5 : 122.580645$ B's stock $\div b = 13s. 7\frac{1}{2}d.$
 per yard

$31 : 80 :: 30 : 77.4193$ C's stock $\div c = 5s.$ per dollar

6th, A, B, and C enter into partnership, A advanced his

share of the stock for 4 months, and thought himself entitled to $\frac{1}{5}$ of the gain, B advanced his for 9 months, C put in L.500 for 6 months, and on balancing the books, wanted $\frac{1}{5}$ of the profits. I demand how much A and B advanced.

$$\frac{1}{5} - \frac{1}{5} + \frac{1}{5} = \frac{1}{5} \text{ B's claim}$$

4).16 A's gain 9).083 B's gain 6).75 C's gain

.0416

.00925,925

.125

L

If .125 : 500 :: .0416 : L.166 13 4 A's stock

.125 : 500 :: .00925 : L.37 0 3 B's stock

7th, A and B in company, divide the gain equally betwixt them, A's stock, which we may suppose to have been (a) L.610, and which continueth in trade (b) 15 months, but B took out his at the end of (c) 9 months, I demand what stock he put in.

If $c : b :: a : L.1016 \ 13 \ 4$ Ans.

8th, A having (a) L.500 in cash, entered into business on the 1st of May 1793, and being successful, admitted B into company, who advanced (c) L.600 on the 1st of November, that same year, 2 months after that, they take in C, who advanced (d) L.1000, and continuing business until the 1st of May 1794, upon balancing their books they found that they had profited in the course of a year (e) L.896. I demand each partner's share in proportion to his stock, and the time it continued in business.

$a \times 12 = 6000$ or A If $s : A :: e : L.395 \ 5 \ 10\frac{1}{2} \frac{4800}{11800}$
 A's share

$c \times 6 = 3600$ or B If $s : B :: e : L.237 \ 3 \ 6\frac{1}{2} \frac{1600}{11800}$
 B's share

$d \times 4 = 4000$ or C If $s : C :: e : L.263 \ 10 \ 7 \frac{1300}{11800}$
 C's share

13600 or s.

Proof, L.896 0 0

INTEREST.

Money lent for a certain time, upon consideration of receiving the same again, with a premium or allowance for using it.

The money lent is called the principal, and the premium or allowance the interest, which is calculated at so much on the L.100 for a year.—This is termed the rate.

When principal and interest are added together, the sum is called the amount.

Interest consists of two kinds, viz. Simple and Compound. Simple interest is that which arises from the principal only.—Compound interest is that which arises from both principal and interest.

To find the interest, when the principal, rate, and time are given.

RULE, Multiply the principal, rate and time together, al-

so, multiply L.100 into as many of the denominations in which the time is given, as make a year—then divide the former product by the latter.—For another Rule see page 12.—Or, to find the interest at any other rate than 5 per cent. multiply the interest found at 5 per cent. by these decimals, viz. for 3 per cent. by .6, for $3\frac{1}{2}$ by .7, for 4 by .8, for $4\frac{1}{2}$ by .9.

Note, p =principal, t =time, r =ratio, and a =amount.

To find the ratio of one pound at any rate per cent. per annum, say, as 100 is to the rate per cent. so is 1 to the ratio.

EXAMPLES.

1st, Required the interest of (a) L.1828 14 6 for (b) 2 years at (c) 5 per (d) cent. per annum.

If $d : c :: a : q \times b = L.182 \ 17 \ 5\frac{1}{2}$ Ans.

2d, What is the interest of (a) L.848 for (b) $3\frac{1}{2}$ years, at (c) $3\frac{1}{2}$ per (d) cent. per annum?

If $d : c :: a : q \times b = L.119 \ 5 \ 0$ Ans.

3d, What is the interest of L.120 10 8 at 4 per cent. per annum for $3\frac{1}{2}$ years?

Ans. L.16 17 $5\frac{1}{2}$

4th, Required the interest of L.176 4 6 from June 3d to January 5th at 5 per cent?

Ans. L.5 4 $3\frac{1}{2}$

5th, Lent $A B$, March 20th, 1797, L.460, required how much interest is due on it this day, 11th November, 1797?

Ans. L.14 17 5

6th, Required the interest due on a bill of L.680 from April 10th, to October 25th, at 4 per cent. per annum?

Ans. L.14 15 1

7th, What interest is due on a bill of L.100 at 4 per cent. from May 30th, 1795, to June 12th, 1797?

Ans. L.8 2 10

When several partial payments are made of the same sum at different periods of time, or when partial sums at different dates are drawn and remitted, multiply the several balances which arise in the course of the operation into the number of days they are at interest, then multiply the sum of the products by the rate per cent. and divide the product by 7300.

EXAMPLES.

8th, Borrowed, April 7th, L.800, of which I paid, May 23d, L.300, July 5th, L.260, September 16th, L.120. I am to pay up the balance, Dec. 29th, how much will then be due, principal and interest? Ans. L.12 2 11

9th, Lent $A B$, August 1st, 1791, L.680 at 5 per cent. of which he paid me as follows, viz. September 17th, L.82, Dec. 16th, L.140, and February 13th, 1792, L.46, June 3d, L.90, and August 31st, L.322, what is the interest?

1791		L	days	
Aug. 1	Lent to $A B$ at 5 per cent.	680	47	31960
Sept. 17	Received	82		
	Balance,	598	90	53820
Dec. 16	Received	140		
	Balance,	458	59	27022
1792				
Feb. 13	Received	46		
	Balance,	412	110	45320
June 3	Received	90		
	Balance,	322	89	28658
Aug. 31	Received	322		
				7300)186780

Ans. L.25 11 $8\frac{1}{2}$

10th, Required the interest of the following accompt at 5 per cent.

Dr. $M. J. B.$ his account current with $W. G.$ and $Co.$ Cr.

Jan. 7	To balance	L.300	April 14	By Cash	L.110
March 7	To Cash	120	June 27	do.	180
May 8	do.	360	Aug. 13	do.	340
July 21	do.	410	Oct. 12	do.	163
Sept. 18	do.	240	Nov. 18	do.	89
Dec. 24	do.	263			

$$300 \times 59 = 17700$$

$$120$$

$$420 \times 38 = 15960$$

$$110$$

$$310 \times 24 = 7440$$

$$360$$

$$670 \times 50 = 33500$$

$$180$$

$$490 \times 24 = 11760$$

$$410$$

$$900 \times 23 = 20700$$

$$340$$

$$560 \times 36 = 20160$$

$$240$$

$$800 \times 24 = 19200$$

$$163$$

$$637 \times 37 = 23569$$

$$89$$

$$548 \times 36 = 19728$$

$$263$$

$$811$$

$$7300)189717$$

Ans. L.25 19 $9\frac{1}{2}$

Interest

Required the interest on a bill of £1000, due March 13th 1798, of which, £200 was paid April 12th, £150, August 25th and the balance October 20th

March 13	due	£1000	30	3000
April 12	paid	200		
	bal:	800	67	53600
June 18	paid	150		
	bal:	650	68	44200
August 25	paid	550		
	bal:	100	65	6500
			73	134300

£18..7..11¹/₄ Ans.

A bill of £300, became due Jan 78th of which £190, was paid March 12th £80, May 30th & the balance Nov 5th Required the interest due at 5 p. Cent.

product 32360 ÷ 7300 = £4..8..7³/₄ Ans.

C
P
a
i
c
r
C
J
M
L
A
i
M
M

11th, Received from Mr. Thomas Manners, the 10th of October, 1794, L.1000, which I returned in the following partial payments, at their respective dates, viz. 10th January, 1795, L.200, 13th May, L.480, 16th of June, L.160, 18th of July, L.60, 30th of December, L.100, how stands it between us with respect to interest, reckoning at 5 per cent?

1794		L	
Oct. 10	Borrowed of T. M.	1000	$\times 92 = 92000$
	at 5 per cent.		
1795			
Jan. 10	Paid	200	
	Balance,	800	$\times 123 = 98400$
May 13	Paid	480	
	Balance,	320	$\times 34 = 10880$
June 16	Paid	160	
	Balance,	160	$\times 32 = 5120$
July 18	Paid	60	
	Balance,	100	$\times 165 = 16500$
Dec. 30	Paid	100	
			7300)222900

Ans. L.30 10 8

12th, Required the interest on the following account at 4 per cent

Dr. C. D. his account current with R. L and Co.	Cr.
Jan. 10 To Balance L.300	April 10 By Cash L.200
March 8 To Cash 60	June 21 do. 210
May 14 do. 180	Aug. 23 do. 180
July 29 do. 360	Oct. 14 do. 270
Sept. 4 do. 409	Nov. 4 do. 112
Dec. 12 do. 140	

	L days	
Jan. 10 To Balance	300	$\times 57 = 17100$
March 8 To Cash	60	
		360
April 10 By Cash	200	$\times 33 = 11880$
		180
May 14 To Cash	180	$\times 34 = 5440$
		340
June 21 By Cash	210	$\times 38 = 12920$
		130
July 29 To Cash	360	$\times 38 = 4940$
		490
Aug. 23 By Cash	180	$\times 25 = 12250$
		310
Sept. 4 To Cash	409	$\times 12 = 3720$

Oct. 14 By Cash

Nov. 4 By Cash

Dec. 12 To Cash

$$719 \times 40 = 28760$$

270

$$449 \times 21 = 9429$$

112

$$337 \times 38 = 12806$$

140

119245

447

4

$$36500)476980$$

Ans. L.13 1 4 $\frac{1}{2}$

13th, Required the interest on the following account to February 9th, allowing 5 per cent. when the balance is due to A. B. and 4 per cent. when due to M. F.

Dr. M. A. B. his account current with M. F.	Cr.
June 12 To Balance L.111	Aug. 14 By Cash L.380
July 22 To Cash 115	Oct. 2 do. 349
Sept. 4 do. 324	Dec. 13 do. 127
Nov. 23 do. 560	
Dec. 19 do. 140	

	Dr.	Cr.
June 12 To Balance L.111	$\times 40 = 4440$	
July 22 To Cash 115		
	226	$\times 23 = 5198$
Aug. 14 By Cash 380		
	154	$\times 21 = 3234$
Sept. 4 To Cash 324		
	170	$\times 28 = 4760$
Oct. 2 By Cash 349		
	179	$\times 52 = 9308$
Nov. 23 To Cash 560		
	381	$\times 20 = 7620$
Dec. 13 By Cash 127		
	254	$\times 6 = 1524$
Dec. 19 To Cash 140		
	394	$\times 52 = 20488$
	44030	12542
	4	
	5)176120	
	35224	
	12542	
	73)226,82	

L.3 2 1 $\frac{1}{2}$ Ans.

14th, Required the interest on the following account, allowing *R. L.* 5 per cent. and *I. R.* 4 per cent.

Dr. Mr. R. L. his account current with I. R.		Cr.
Feb. 1 To Balance L. 110	May 20 By Cash L. 200	
June 11 To Cash 46	Aug. 12 do. 46	
Sept. 6 do. 110	Oct. 14 do. 150	
Nov. 30 do. 340	Jan. 27 do. 180	
Dec. 4 do. 316		

Dr.		Cr.
Feb. 1 To Balance L. 110 $\times 108 =$	11880	
May 20 By Cash 200		
	90 $\times 22$	1980
June 11 To Cash 46		
	44 $\times 62$	2728
Aug. 12 By Cash 46		
	90 $\times 25$	2250
Sept. 6 To Cash 110		
	20 $\times 38$	760
Oct. 14 By Cash 150		
	130 $\times 47$	6110
Nov. 30 To Cash 340		
	210 $\times 4$	840
Dec. 4 To Cash 316		
	526 $\times 54$	28404
Jan. 27 By Cash 180		
	41884	13068
Balance 346	10454	4
	7300) 31430	5) 52272

Ans. L. 4 6 $1\frac{1}{4}$ 10454

15th, Lent on bond, April 10th, 1789, the sum of L. 800 at 5 per cent. of which I received, July 2d, 1790, L. 400, October 17th, 1791, L. 104, the balance is to be paid January 1st, 1792, required how much I have then to receive?
Lent L. 800

49.09589 interest	
849.09589	
400. paid	
449.09589	
29.03743 interest	
478.13332	
104. paid	
374.13332	
3.89508 interest	
378.02840 <i>Ans.</i>	
or L. 378 0 $6\frac{1}{4}$	

INSURANCE

Is a security granted by underwriters to adventurers, in consideration of a certain sum paid to those who insure, which varies in proportion to the risk. Policy, is a writ specifying the conditions agreed upon betwixt the insurer or underwriter and the adventurer. Short recovery is the sum received in case of a loss, which is commonly L. 98 instead of 100, which is particularly mentioned in the policy. Covering the outset is, when the value of the cargo, &c. with premium and discount are insured also, in order to entitle the adventurer to a full indemnification, in case of a loss, to what was risked. Average, is the proportion of each underwriter of the damage or loss, according to their several subscriptions.

CASE 1.

When the rate per cent is given to find the premium, say, as 100 is to the rate per cent. so is the sum insured to the premium, or take aliquot parts of the rate per cent. and work by Practice.

EXAMPLES.

1st, At (a) 5. per (b) cent. what premium will pay for insuring (c) L. 645 10?

If $b : a :: c : L. 32 \ 5 \ 6$ *Ans.*

2d, What premium must be paid for insuring (a) L. 1348 at (b) $6\frac{1}{4}$ per (c) cent?

As $c : b :: a : L. 90 \ 19 \ 9\frac{1}{4}$ *Ans.*

3d, At (a) 14 guineas per (b) cent. premium, what will insure (c) L. 838 16 8?

If $b : a :: c : L. 123 \ 6 \ 2$ *Ans.*

CASE 2.

When the discount per cent. is given to find the short recovery, say, if 100 give the rate per cent. what will the sum insured give; or take the aliquot parts, and work as in Practice.

EXAMPLES.

1st, What is the short recovery of (a) L. 1000 insured when discount is allowed at (b) 2 per (c) cent?

$2 = \frac{1}{50}$ 1000 at 2 per cent.

20

980 *Ans.* or If $100 : 98 :: 1000 : L. 980$
short recovery.

2d, At $2\frac{1}{2}$ per cent. discount, what sum will be recovered for L. 1865?

Ans. L. 1818.375

3d, At $2\frac{1}{2}$ per cent. discount, what sum must be recovered for L. 3678?

Ans. L. 3576.855

CASE 3.

When the rate per cent. premium and discount are given to find what sum must be insured to cover the outset in a

single voyage, subtract the sum of the premium and discount from 100, and then say, as the remainder is to 100, so is the outset to the answer.

EXAMPLES.

1st, If the premium be (a) 8 per (b) cent. and the discount (c) 2 per (d) cent. what sum must be insured to cover (e) L.100 outset?

$$a + c = s - b = r : b :: d : p = L.111 \quad 2 \quad 2\frac{1}{2} \text{ Ans.}$$

For proof, deduct 2 per cent from the answer, that gives what the insurer pays in case of a loss; then again from the same answer deduct 8 per cent. for premium, which subtract from what the insurer pays in case of a loss.

2d, If the premium be $12\frac{1}{2}$ per cent. and the discount $2\frac{1}{2}$ per cent. what sum must be insured in order to cover L.600 outset?

$$\text{Ans. L.705 } 17 \quad 7\frac{1}{2}$$

3d, What sum must I insure to cover L.1145 premium, 15 guineas per cent. $2\frac{1}{2}$ per cent. discount in case of loss?

$$\text{Ans. L.1400 } 12 \quad 2\frac{1}{2}$$

CASE 4.

The rate per cent. of premium and discount being given to find the premium out and home, what sum must be insured to cover the inset.

First find the premium on the voyage out as taught above, and for the voyage home work thus: From the short recovery deduct the premium, then say, as the remainder is to the premium, so is the sum of the outset and premium of the voyage out, to the premium of the voyage home, which added to the premium of the voyage out, gives the total premium. Lastly, find what sum insured will cover the inset by Case 3d.

EXAMPLES.

1st, If the premium be 8 per cent. and the discount 2 per cent. what premium must be paid for insuring L.100 out and home, and what sum must be insured to cover the inset?

$$\text{If } 90 : 100 :: 100 : 111.11 - 2 \text{ p. c.} = 108.88 - 100 = 8.88 \text{ prem. out}$$

$$98 - 8 = 90 : 8 :: 108.88 : 9.679 \text{ prem. home} + 8.8888 \text{ prem out} = 18.5678 \text{ total premium}$$

$$90 : 100 :: 108.88 : L.120.987 \text{ Ans.}$$

2d, What sum must I insure to cover a voyage out and in per L.5676, premium 10 per cent. discount 2 per cent. in case of loss?

$$\begin{array}{r} 10 \quad 100 \\ 2 \quad 12 \\ \hline 12 \quad 88 \end{array}$$

$$88 : 100 :: 5676$$

$$100$$

$$88)567600$$

$$6450$$

$$\text{Deduct 2 per cent. discount } 129$$

$$\text{Insurer pays } 6321 \text{ in case of loss}$$

$$\text{Deduct 10 per cent. prem. out } 645$$

$$5676 \text{ outset}$$

$$\text{As } 88 : 10 :: 6321 : 718.2954 \text{ premium home}$$

$$645. \text{ premium out}$$

$$1363.2954 \text{ total premium}$$

Lastly, by Case 3d find what sum must be insured to cover L.6321

$$\text{As } 88 : 100 :: 6321 : L.7182.954 \text{ Ans.}$$

3d, What sum must I insure to cover L.812 for a voyage out and in, premium 16 guineas per cent. and 2 per cent. discount in case of loss?

$$\text{Ans. L.1206.89655}$$

FACTORAGE.

The business of a factor or agent consists in transacting the affairs of other persons, by having goods consigned to them for sale, or orders sent to make purchases on their account, &c. &c. for which they receive a certain allowance called Commission or Agency, which is generally so much per cent. on the sale or purchase.

RULE.

Multiply by the rate per cent. and divide by 100, or compute by the rules of Practice.

EXAMPLES.

1st, Sold a consignment from Jamaica, amounting to (a) L.3000, what does my commission come to at (b) 5 per (c) cent. and what is the nett proceeds, deducting (d) L.189 for freight, duty, and other charges?

$$\text{If } c : b :: a : q + d - a = L.2661 \text{ nett proceeds}$$

$$c : b :: a : L.150 \text{ commission}$$

2d, My factor in America sends me an account of sales of L.2560 19 8 $\frac{1}{4}$, what is his commission at 7 $\frac{1}{2}$ per cent. deducting an account of disbursements of L.89 10, I demand how much I can draw for?

$$\text{Ans. L.2279 } 8 \quad 2\frac{1}{2}$$

2d, Purchased for my constituent in Grenada, goods to the amount of L.1589 16 8, incidental charges on the purchase came to L.51 10, for how much may I draw, including commission at 3 $\frac{1}{2}$ per cent?

$$\text{Ans. L.1482 } 13 \quad 9\frac{1}{4}$$

DISCOUNT, OR REBATE *

Is a certain allowance given on money paid before it becomes due, and which ought to be the difference between the present worth, and its value due after the time specified.

* A simple way to show the nature and propriety of this Rule is to compare the compound interest of any sum for several years, with the discount of the same sum for the same rate and time.

To find the discount, multiply the time and rate together for the first product, also multiply 100 by a year in the same denomination for the second product, and say, as the sum of the products is to the first product, so is the given sum to the discount, which, when subtracted from the given sum, leaves the present worth. Or, to find the present worth, as the sum of the products is to the second product, so is the given sum to the present worth, which, when subtracted from the given sum leaves the discount or rebate.

EXAMPLES.

1st, What discount should be allowed on a legacy of (a) L.5000 at (b) 5 per (c) cent. per (d) annum, due (e) 10 years hence?

$$e \times b = 1st\ p$$

$$c \times 1 = 2d\ p + 1st\ p = s : 1st\ p :: a : L.1666\ 13\ 4$$

$$s : 2d\ p :: a : L.3333\ 6\ 8$$

present worth when subtracted from a = discount

2d, What ready money will pay a debt of (a) L.1600, due (b) 11 years hence, at (c) 4 per (d) cent. per annum?

$$b \times c = 1st\ p \quad d \times 1 = 2d\ p + 1st\ p = s : 1st\ p :: a :$$

$$L.488\ 17\ 9\frac{1}{4}\ \text{discount}$$

$$\text{As } s : d :: a : L.1111\ 2\ 2\frac{1}{2}\ \text{present worth}$$

3d, What should be given for a bill of (a) L.500, due (b) 18 weeks hence, discount being allowed at (c) $4\frac{1}{2}$ per (d) cent. per (e) annum?

$$b \times c = 1st\ p \quad d \times 52 = 2d\ p + 1st\ p = s$$

$$\text{As } s : 2d\ p :: a : L.492\ 6\ 7\frac{1}{4}\ \text{present worth}$$

PRACTICAL DISCOUNT.

Those who discount bills add to the time three days of grace, and find the interest, which they subtract to find the present worth. It is also a practice with many, to take $\frac{1}{4}$ or $\frac{1}{2}$ per cent. or some times more, which is also added to the interest before subtraction.

EXAMPLES.

1st, What is the present worth of a bill of (a) L.600, due (b) October 25th, and discounted (c) August 3d, deducting (d) days of grace, and (e) $2\frac{1}{2}$ per (f) cent. commission?

$$\text{From c to b is } 83\ \text{days} + d = 86 \times a \div 7300 = L.7\ 1\ 4\frac{1}{4}$$

interest

$$\text{If } f : e :: a : \text{commission} + \text{interest} - a = L.577\ 18\ 7\frac{1}{4}$$

Ans.

2d, What is the present worth of (a) L.650 at (b) $4\frac{1}{2}$ per (c) cent. discount, due the (d) 15th of December, but paid the (e) 5th of September, deducting (f) days of grace, and commission at (g) $1\frac{1}{2}$ per (h) cent?

$$\text{From e to d is } 101\ \text{days} + f = 104 \times a \times b \div 36500 =$$

$$L.8\ 6\ 8\ \text{interest}$$

$$\text{As } c : g :: a : \text{commission} + \text{interest} - a = L.631\ 18\ 4$$

present worth

3d, What ready money will pay a debt of L.500, due 80 days hence, allowing $1\frac{1}{2}$ per cent commission?

$$\text{Ans. } L.487\ 0\ 5$$

4th, A bill of L.500, dated January 10th, payable August 8th, was presented March 14th for discount at $4\frac{1}{2}$ per cent. what will the rebate come to? *Ans. L.9.565*

When the principal, amount and time in years are given to find the rate, say, as the product of the principal and time is to the difference of the principal and amount, so is 100 to the rate per cent.

EXAMPLES.

1st, At what rate of interest will (a) L.584 6 8 amount to (b) L.682 18 $9\frac{1}{2}$ in (c) $3\frac{1}{4}$ years?

$$a - b = r \text{ and } a \times c = p : r :: 100 : 4\frac{1}{2}\ \text{per cent. } \text{Ans.}$$

2d, At what rate of interest per cent. will L.275 gain L.8 5 in 219 days? *Ans. 5 per cent.*

When principal, amount and rate are given to find the time in years, divide the difference of the principal and amount by the product of the principal and rate of L.1, that is, as 1 year's interest of the principal is to 1 year, so is the total interest to the time sought.

EXAMPLES.

1st, In what time will (a) L.500 amount to (b) L.700, at (c) $4\frac{1}{2}$ per (d) cent?

$$\text{If } d : c :: 1 : a \times a = p \text{ and } b - a \div p = 8.42105\ \text{years.}$$

Note, If the time be required in days multiply the difference of the principal and amount by 365, and proceed as before.

2d, In how many days will (a) L.300 principal gain (b) L.10 19 at (c) 5 per (d) cent?

$$\text{If } d : c :: 1 : a \times a = p \text{ and } b \times 365 \div p = 266.45\ \text{days.}$$

When the amount, time and rate per cent. are given to find the principal, say, as the amount of L.100 at the rate and time is to L.100, so is the amount given to the principal required.

EXAMPLES.

1st, What principal being put to interest for 9 years at 5 per cent. per annum will amount to L.725?

$$\text{Ans. } L.500$$

2d, What principal being put to interest for 7 years will amount to L.793 12 at 4 per cent. per annum?

$$\text{Ans. } L.620$$

3d, What sum being put to interest will amount to L.520 16 in 8 years at 3 per cent. per annum? *Ans. L.420*

EQUATION OF PAYMENTS *

Is the finding a time at which a debt due at different times may be discharged at once without disadvantage to either party.

RULE.

Multiply each payment by the time at which it is due, divide the sum of the products by the sum of the payments, and the quotient will be the time required.

EXAMPLES.

1st, A owes B (a) L.800, whereof (b) L.60 is to be paid presently, (c) L.290 at the end of (d) 4 months (e) L.450 at (f) 8 months, required the equated time for paying the whole?

$$b \times o = p$$

$$c \times d = p$$

$$e \times f = p$$

$$s \div s = 5\frac{1}{2} \text{ months } \text{Ans.}$$

2d, A owes B a certain sum of money, whereof (a) $\frac{1}{2}$ to be paid in ready money, (b) $\frac{1}{3}$ at the end of (c) 9 months, and the other (d) $\frac{1}{6}$ at (e) 6 months, required the equated time for paying the whole?

$$a \times o = p$$

$$b \times c = p$$

$$d \times e = p$$

$$s \div s = 5 \text{ months } \text{Ans.}$$

3d, C owes D (a) L.1000, whereof (b) L.300 is to be paid presently (c) L.280 at (d) 9 months, and the (e) rest at (f) 8 months, required the equated time for paying the whole?

Ans. 5 $\frac{1}{3}$ months

4th, Paid L.600 as follows, L.80 in 40 days, L.160 in 100 days, L.180 in 250 days, and the rest in a year and 36 days, required the equated time for paying the whole?

Ans. 227 $\frac{1}{6}$ days

5th, A debt of L.1900 is to be paid as follows, viz. $\frac{1}{4}$ at 8 months, $\frac{1}{2}$ at 10 months, and the rest in 1 $\frac{1}{2}$ years, what is the equated time to pay the whole?

Ans. 10 $\frac{1}{4}$ months

EXCHANGE

Teaches how to change the money of one country into that of another, without altering its intrinsic value.

By the course of exchange is meant the value of money agreed on by merchants, and varies in proportion as it is plenty or scarce, sometimes falling, and sometimes rising above par, and may be conceived to rise or fall like the prices of other commodities. But it may be concluded as certain, that the country where it rises above par, has the balance of trade against it.

Par, is the real value of any money, and is fixed, at least,

* This Rule, notwithstanding of the many disputes to which it has given rise, seems to be best understood from the consideration of Interest and Discount.

very generally agreed upon.—Agio, is the difference between currency and bank money, but fluctuates more or less in different countries.—Ufance, is a certain space of time allowed for bills, &c. to pass from one country to another, but varies according to the distance of the place on which the bill is drawn.—Days of grace, is a legal indulgence of three days in Britain, granted to the acceptant of a bill after the expiry of the time of payment, before it can be protested.

EXCHANGE WITH HOLLAND.

MONEY TABLE.

Par in sterling.

8 pennings, or 2 duytes,	} make	1 groator penny =	0 0,54
2 groats, or 16 pennings,		1 stiver =	0 1,09
6 stivers, or 12 pence,		1 schilling =	0 6,56
20 schillings,		1 pound Flemish =	10 11,18
20 stivers,		1 guilder or florin =	1 9,86
6 guilders, or florins,		1 pound Flemish =	10 11,18
2 $\frac{1}{2}$ guilders, or florins,		1 rixdollar =	4 6,66

Exchange from 33s. 6d. to 36s. 6d. Flemish, or grofs per pound sterling, which at par, is equal to 36.59 s. fl. Agio from 3 to 6 per cent.

To turn current money into banco, and banco into current money, say, as 100 with the agio added to it is to 100, so is any given sum in current money, to its value banco.—And as 100 is to 100 with the agio added to it, so is any given sum banco to its value in current money.

Note, The exchange is supposed to be made in bank money, and therefore current money must always be turned into bank money, before the exchange can be made; so that if accounts are transmitted in current money to Britain, the merchant pays them by bills, and consequently gains the agio.

To turn Flemish pounds and shillings into guilders, multiply by 6; and if there be any pence multiply them by 8 for pennings.

When the rate is 33s. 4d. 2 shillings sterling are equal to a guilder.

EXAMPLES.

1st, In (a) 500 guilders or florins banco, agio (b) 3 $\frac{1}{4}$ per (c) cent. how much currency?

If $c + b : c :: a : 516 \text{ guilders, } 5 \text{ stivers, } \text{Ans.}$

2d, In (a) 516 guilders, 5 stivers currency, how much banco, agio (b) 3 $\frac{1}{4}$ per (c) cent?

If $c + b : c :: a : 500 \text{ guilders, } \text{Ans.}$

Note, This question proves the 1st.

3d, In L.500 Flemish, how many guilders and pounds sterling, exchange 33s. 4d. per pound sterling?

500

6 fee note 2d.

$2s. = \frac{1}{10}) 3000 \text{ guilders. See note 4th.}$

L.300 sterling.

4th, In (a) 6784 guilders banco, exchange (b) 34s. 9d. how much (c) sterling?

If $b \times 12 : c :: a \times 40 : L.650 \ 14 \ 10\frac{1}{4}$ sterling.

5th, In (a) L.300 sterling, how many pounds Flemish, exchange (b) 36s. 7d. per (c) pound sterling?

If $b : c :: a : L.548 \ 15$ Flemish *Ans.*

6th, What is the value of the (a) guilder when the exchange is (b) 35s. 6d. per (c) pound sterling?

If $b : c :: a : 22d. \frac{1}{4}$ sterling *Ans.*

7th, In (a) 7568 guilders currency, how much sterling, exchange at (b) 35s. 6d. banco, per (c) pound sterling, agio at (d) 5 per (e) cent?

If $d + e : c :: a : q.$ guilders banco

If $b : c :: q : L.676 \ 15 \ 5$ sterling *Ans.*

8th, Britain remits Amsterdam 3968 guilders, 15 stivers, how much sterling will pay the bill, exchange 35s. 2d.?

L.376 $2 \ 8\frac{1}{4}$ sterling *Ans.*

9th, When the value of the (a) guilder is (b) 22d. $\frac{1}{4}$ what is the rate of exchange?

If $b : a :: 1 \text{ L. sterling} : 35s. \ 6d. \text{ Ans.}$

10th, When the current guilder is worth (a) 22d. sterling, what is the value of the bank guilder, the agio being (b) 4 per (c) cent?

If $c : c + b :: a : d.22.88$ sterling *Ans.*

11th, How much sterling in (a) 3930 guilders currency, agio (b) $2\frac{1}{4}$ per (c) cent. exchange (d) 35s. 2d. per (e) pound sterling?

If $c + b : c :: a : q$ guilders banco

If $d : e :: q : L.362.5419$ sterling *Ans.*

12th, How many guilders currency in (a) L.2025 sterling, agio (b) 3 per (c) cent. exchange (d) 35s. 6d. per (e) pound sterling?

If $e : d :: a : q \text{ Fl.} \div 40 = g. \text{ b.}$

If $c : c + b :: q : 22213.2375$ guilders cur. *Ans.*

CRITERION.

In 87 moidores, L.336 $5, \ 78$ joanneses, 38 nobles, 54 marks, 67 guineas, 54 half guineas, 28 seven shilling pieces, how many guilders banco and current, agio 3 per cent. exchange at 35s. 6d. Flemish, per pound sterling?

Ans. 8003.65 guilders banco

and 8243.762 guilders current

EXCHANGE WITH HAMBURGH.

MONEY TABLE.

	Par in sterling.	s	d
12 phennings	} make {	1 schilling lub	= 0 $1\frac{1}{8}$
16 schilling lubs		1 mark	= 1 6
2 marks		1 dollar	= 3 0
3 marks		1 rix dollar	= 4 6
6 $\frac{1}{4}$ marks		1 ducat	= 9 $4\frac{1}{2}$

Also, 10 MOIT Flemish

6 phennings	} make {	1 groot or penny
6 schilling lubs		1 schilling
1 schilling lub		2 pence, or groots
1 mark		32 pence, or groots
7 $\frac{1}{2}$ marks		1 pound or liver gros

Hamburgh exchanges with other countries as follows, viz. with

Holland on the dollar	=	62d. $\frac{1}{4}$ Flemish
France on the crown	=	51d. $\frac{1}{4}$ do.
Spain on the ducat	=	52 $\frac{1}{2}$ schilling lubs
Portugal on the crusade	=	48d. Flemish
Venice on the ducat	=	89d. $\frac{8}{10}$ do.
Leghorn on the piafre	=	96d. do.

Note, The agio at Hamburgh runs between 20 and 40 per cent. All bills are paid in bank money as in Holland.

The par with Hamburgh is 35s. 6d. $\frac{2}{3}$ Flemish, for L.1 sterling.

EXAMPLES.

1st, In (a) L.540 sterling, how many (b) marks, exchange (c) 35s. 6d. Flemish, per (d) pound sterling?

$L \quad d \quad L \quad d \quad \text{mar} \quad \text{sch}$

If $d : c :: a : 230040 \div 32 = 7188 \ 12$ *Ans.*

2d, In (a) 7188 marks, 12 schilling lubs, how much sterling, exchange (b) 35s. 6d. Flemish, per (c) pound sterling?

$d \quad L \quad d$

If $b : c :: a : L.540$ sterling *Ans.*

This question proves the preceding one.

Note, To bring marks to guilders say, as 40 is to 32, so is the given marks to the guilders sought.

3d, In 600 marks how many guilders?

If $40 : 32 :: 600 \text{ or } \frac{1}{3} 600$

$600 \quad 120$

$4|0)1920|0$

480 guild *Ans.*

480 guilders

Note, 32 pence Fl. = 1 mark.

4th, In (a) 29491 marks, 4 schillings, how much sterling, agio (b) 30 per (c) cent. exchange (d) 33s. 4d. gros per (e) pound sterling?

$s \text{ F} \quad m \quad s \text{ F}$

If $20 : 7\frac{1}{2} :: d : 12\frac{1}{2}$ marks in a pound sterling

If $c + b : c :: a : 22685.5769 \div 12.5 = L.1814.846$ *Ans.*

5th, In (a) 5000 mark lubs, how many guilders, exchange (b) 34 $\frac{1}{2}$ stiv. banco per dollar?

$m \text{ l} \quad \text{fl} \quad m \text{ l}$

If $2 : b :: a : 4312$ guilders, 10 stivers *Ans.*

Note, Exchange with Holland about 33 stivers banco per dollar of Hamburgh.

2 marks = 1 dollar.

6th, What is the value of the mark banco, exchange at 35s. 2d. Flemish banco per pound sterling?

$$\begin{array}{ccccccc} s & m & s & d \\ \text{If } 20 : 7\frac{1}{2} :: 35 & 2 : 13.1875 \text{ marks in } 35s. 2d. \\ m & s & m & d \end{array}$$

If 13.1875 : 20 :: 1 : 18.199 sterling *Anf.*

7th, Hamburg is indebted to Britain (a) 2464 marks, current money, for how many marks may Britain draw on the Bank, the agio being (b) 25 per (c) cent?

If $c+b : c :: a : 1971 \text{ marks, } 3 \text{ sch. } 2\frac{1}{2} \text{ phen. } \textit{Anf.}$

8th, What is the sterling value of a (a) mark lub, when the exchange between Britain and Hamburg is (b) 35s. 8d. Flemish per (c) pound sterling?

If $b : c :: a : 17d. \frac{10}{18} \text{ } \textit{Anf.}$

9th, How many mark lubs current in (a) 5000 guilders current, agio in Holland (b) 3 per cent. exchange (c) 32½d. stivers, agio in Hamburg (d) 20 per (e) cent?

If $e+b : e :: a : g. b.$

$\textit{fl m l}$

If $c : 2 :: \text{guild. } b : m. l. \text{ banco}$

If $c : e+d :: m. l. \text{ banco} : 7169.5294 \textit{ } \textit{Anf.}$

CRITERION.

What is the sum in sterling of ½ moidore + ¼ guinea + .75

shilling + ¾ mark + 4.9876 nobles + 6½ crowns + 385 guilders, 13 stivers current, agio 2½ per cent. exchange 35s. 4d. Flemish per pound sterling + 2867 marks, 8 schilling lubs, agio 25 per cent? *Anf. L.214.0289*

EXCHANGE WITH FRANCE.

MONEY TABLE.

	Par in sterling.	s	d
12 deniers	1 fol	=	0 0½
20 fols	1 livre	=	0 9½
3 livres	1 crown	=	2 5½

France exchanges with other places also on the crown, the par being as follows, viz.

1 French crown in Spain	=	184½ mervadies
Portugal	=	431½ rees
Milan	=	62 foldi
Sardinia	=	9½ foldi
100 French crowns in Naples	=	72½ ducats
Florence	=	45 crowns
Denmark	=	54 rubles
Sweden	=	78 rix dollars

Note, The exchange with Britain is on the crown or ecu of 3 livres, or 60 fols tournois, which is rated from 30 to 34d. the par being as mentioned in the table 29½.

EXAMPLES.

1st, What sterling must be paid in London to receive in Paris 2000 crowns, exchange at 32½d. per crown?

2000 at 32½d. = L.270 16 8 *Anf.*

2d, How many French livres will (a) L.220 6 8 sterling amount to, exchange at (b) 33½d. per (c) crown?

$$\begin{array}{ccccccc} d & liv & d & liv & fols & den \\ \text{If } b : c :: a : 4700 & 8 & 10\frac{6}{9} \textit{ } \textit{Anf.} \end{array}$$

3d, In 4768 livres, how much sterling, exchange at 29½d. per crown? *Anf. L.193 14*

4th, In 840 crowns, 2 livres, 18 fols, and 4 deniers, how much sterling, exchange at 31d. per crown?

Anf. L.108 12 6½

5th, In 74645 guilders current, how much French, agio 3½, exchange 28½ stivers banco per crown?

stivers banco

$$\begin{array}{ccccccc} \text{If } 103\frac{1}{2} : 100 :: 74645 : 1442415.4580 \\ \textit{fl liv fliv liv} \end{array}$$

If 28½ : 3 :: 1442415.4580 : 15183.3206 *Anf.*

6th, How many French crowns may I have for L.800 13 4 at 30½d. per crown?

crowns liv fol den

Anf. 6352 1 3 9

CRITERION.

In 576½ moidores, 396½ guineas, 98½ half guineas 250½ guilders current, exchange 35s. 6d agio 3, 789.856 current marks, ex. 35s. 6d. agio 23—567 French crowns, 158 livres, ex. 30½d. and L.176 16 8½, how much sterling?

Anf. L.1573 8 1½

EXCHANGE WITH PORTUGAL.

Par in sterling.

		s	d	f
400 rees	1 ree	=	0 0	0.27
1000 rees	1 crusado	=	2 3	
6400 rees	1 milree	=	5 7½	
4800 rees	1 joannes	=	36 0	
	1 moidore	=	27 0	

Portugal exchanges with other places as follows, viz.

	Rees
Spain on the piastre	= 637
Venice on the ducat	= 744
Genoa on the pezzo	= 800
Naples on the ducat	= 597
Sardinia on the dollar	= 637
Palermo on the crown	= 889

Note, Merchants keep their books by rees and milrees, and as rees are the thousandth part of milrees, the computation proceeds exactly the same as in decimals.

EXAMPLES.

1st, In (a) L.540 17 10½, how many milrees, exchange (b) 68½d. per (c) milree?

$$\begin{array}{ccccccc} d & m & d & \textit{milrees} \\ \text{If } b : c :: a : 1895.102189 \textit{ } \textit{Anf.} \end{array}$$

2d, In (a) 4540 milrees, how much sterling, exchange (b) 64½d. per (c) milree?

$$\begin{array}{ccccccc} m & d & m \\ \text{If } c : b :: a : L.1224 & 17 & 1 \textit{ } \textit{Anf.} \end{array}$$

3d, In 7360 milrees, how many guilders, exchange 50, agio 3?

rees d rees d
If 400 : 50 :: 7360000 : 920000
If 100 : 103 :: 920000 : 947600 ÷ 40 = 23690 guilders *Anf.*

Note, Exchange with Holland about 50d. gros per crusado.

4th, How much money of France in (a) 640 milrees, exchange (b) 431 rees per (c) ecu or crown?

rees liv rees liv fol den
If b : c :: a : 4454 15 1. *Anf.*

5th, Shipped for France 1500 barrels herrings at a joannes per barrel, what is the nett proceeds in sterling, exchange at 65d. per milree?

b rees b rees
If 1 : 6400 :: 1500 : 9600000
If 1000 : 65 :: 9600000 : L.2600 sterling.

CRITERION.

In 789½ guineas, L.18761½, 7869½ guilders current, agio 2½, 7968½ marks current of Hamburgh, agio 22, 3876 milrees, ex. 50d. Flemish per crusado, 578½ moidores, 7000 joannes, how much Flemish money, exchange 35s. 3d.?

Anf. L.62280.1228

EXCHANGE WITH SPAIN.

MONEY TABLE.

	Par in sterling.	s	d
34 mervadies	1 rial =	0	5½
8 rials old plate, or	} make {	1 piaftre =	3 7
10 rials new plate		1 ducat =	4 11½
375 mervadies			

Spain exchanges with other places as follows, viz. with

	<i>mervadies</i>
Venice on the ducat	= 318
Genoa on the pezzo	= 341½
Rome on the crown	= 464
Florence on the crown	= 409
Naples on the ducat	= 255
Milan on the ducat	= 348
Bologna on the dollar	= 322½
Messina on the crown	= 380

The principal places in Spain keep their books in piaftres, also called dollars, rials, and mervadies.

The course runs from 35 to 45d. sterling for a piaftre or dollar of 8 rials.

Spain has two sorts of silver money, viz. old and new plate, the first of which is 25 per cent. better than the last, and by this money bills of exchange are negotiated, but shopkeepers reckon by copper money or vellon.

EXAMPLES.

1st, In (a) 3436 piaftres, how much sterling, exchange at (b) 42d. sterling, per (c) piaftre?

p d p
If c : b :: a : L.601 6 *Anf.*

2d, How much Spanish money in (a) L.601 6, exchange at (b) 42d. per (c) piaftre?

d p d
If b : c :: a : 3436 piaftres *Anf.*

3d, In 734 guilders, 18 stivers, how many rials plate, exchange 107d. Flemish per ducat, or 375 mervadies, agio 3?

fl c fl ban fl c stivers
If 103 : 100 :: 14698 : 14269.9 = 28539.8 pence

m r m rials plate
If 107 : 375 :: 28539.8 : 100022.6635 mervadies

m r m rials plate
If 34 : 1 :: 100022.6635 : 2941.843 *Anf.*

4th, How many guilders in (a) 8000 rials plate, exchange (b) 110d. Flemish, per (c) ducat?

m d m d
If c : b :: a : 79786.6 = 1994.6 guilders *Anf.*

5th, In 1676 dollars (or piaftres) 6 rials, how much sterling, exchange at 36d. sterling per piaftre?

Anf. L.251 10 3 sterling.

6th, In 14000 rials plate, how many milrees, exchange 630 rees per piaftre?

Anf. 1102.5 milrees

CRITERION.

In L.78½, 7967½ guilders current, agio 3—7864½ marks current, agio 20, ex. 32 stivers banco, per rix dollar of Hamburgh—760 livres, ex. 28 stivers per crown—8996 milrees, ex. 49d. Flemish per crusado—7869 rials plate, exchange 108d. per ducat, how many guilders banco, ex. 35s. 4d.?

Anf. 41895.8998

EXCHANGE WITH VENICE.

MONEY TABLE.

12 denari or deniers d'or	} make {	1 fol d'or, or foldo
20 foldo, or fols d'or		1 ducat lire, or piaftre of Leghorn
5½ foldi		1 gros, or grofo
24 gros, or grofi		1 ducat = 50½d. sterling
100 ducats banco of Venice	in Leghorn	= 93 pezzos
	in Rome	= 68½ crowns
	in Lucca	= 77 crowns
	in Francfort	= 139½ florins

Venice has three kinds of money, viz. banco money, banco current money, and picoli money. The banco is 20 per cent. better than the banco current, and the picoli money 20 per cent. worse than the banco current.

The course of exchange is from 45 to 55d. sterling per ducat, par 4s. 2½d. per ducat banco, on which exchanges are always made. In reducing current to banco, observe the same rules as are given before for Dutch money.

EXAMPLES.

1st, How much sterling is equal to (a) 1365 ducats, 16 fols, 8 deniers, bank money of Venice, exchange (b) 53d. sterling, per (c) ducat?

If c : b :: a : L.301 12 5½ sterling *Anf.*

2d, How many ducats at Venice are equal to L. 301 12 5 $\frac{1}{8}$ sterling, exchange at 4s. 5d. per ducat?

ducats fols deniers
Ans. 1365 16 8

3d, In (a) 5040 current crowns of Rome, exchange (b) 64 stamped crowns per (c) 100 ducats, how many ducats banco of Venice?

c d c
If $b : c :: a : q \times 10 \div 12 : 6562.5$ ducats Ans.

4th, In 3000 liras current of Venice, agio 25, exchange 90d. agio 20, how much Hamburg current money?

li d liras d
If $7\frac{1}{2} : 90 :: 3000 : q \times 125 \div 100 \times 120 \div 100 \div 32 = 1687.5$ mark lubs Ans.

Note, 10 julios = 1 current crown
12 do = 1 stamped crown
7 $\frac{1}{2}$ liras = 1 ducat

EXCHANGE WITH GENOA.

MONEY TABLE.

12 denari } make { 1 foldi
20 foldi } { 1 pezzo, or lire = 4s. 6d. sterl.
1 pezzo of exchange } { 5 $\frac{1}{4}$ liras

Course from 47 to 58d. sterling per pezzo.

	<i>Soldi of Genoa</i>
In Milan 1 crown	= 80
In Naples 1 ducat	= 86
In Leghorn 1 piastra	= 20
In Sicily 1 crown	= 127 $\frac{3}{8}$

To reduce exchange money to lire money multiply by 5 $\frac{1}{4}$ and the contrary.

EXAMPLES.

1st, How much sterling money is equivalent to (a) 3940 pezzos, 15 foldi of Genoa, exchange at (b) 54d. sterling per (c) pezzo?

p d p
If $c : b :: a : L. 885 \ 13 \ 4\frac{1}{2}$ Ans.

2d, In (a) 4678 liras of Genoa, how much French, exchange (b) 106 fols per (c) pezzo?

liras fols liras fols liras fols deniers
If $c : b :: a : q \div 20 = 4311 \ 17 \ 10$ Ans.

CRITERION.

In L. 7968 $\frac{1}{2}$, 7643 $\frac{1}{2}$ guilders current, agio 2 $\frac{1}{2}$, 3859 $\frac{1}{2}$ current marks of Hamburg, agio 18, 3766 livres, ex. 25 sh. lubs per crown, 7986 milrees, ex. 425 rees, and 26 sh. lubs, per crown, 8000 rials plate, ex. 109d. Flem. per ducat, 76589 $\frac{3}{4}$ pezzo, ex. 52d. sterling per pezzo, how many Hamburg marks banco, ex. 35s. 6d. Flemish per pound sterling?

Ans. 374556.9689

EXCHANGE WITH LEGHORN.

MONEY TABLE.

12 denari } make { 1 foldi
20 foldi } { 1 piastra = 4s. 6d. sterling

Accounts are kept in piastras, foldi, and denari.

Note, 1 piastra = 6 liras
1 lire = 20 foldi

Exchange money is 6 times better than lire money, the course of exchange is from 47 to 58d. per piastra.

100 piastras of Leghorn are in Naples = 134 ducats

in Geneva = 185 $\frac{1}{2}$ crowns

in Sicily 1 crown = 133 $\frac{1}{2}$ foldi of Leghorn

in Sardinia 1 dollar = 95 $\frac{1}{2}$ do.

EXAMPLES.

1st, What is the sterling value of (a) 632 piastras at (b) 50d. per (c) piastra?

p d p
If $c : b :: a : L. 131 \ 13 \ 4$ sterling Ans.

2d, In (a) L. 140 12 8 sterling, exchange (b) 54d. per (c) piastra, how many liras?

d liras d
If $b : c :: a : 3750.2$ liras Ans.

EXCHANGE WITH RUSSIA.

MONEY TABLE.

3 copecs	}	make	1 altine
10 copecs			1 grivena
25 copecs			1 polpolitin
2 polpolitins			1 politin
2 politins			1 ruble
2 rubles			1 ducat

At Petersburg, accounts are kept in rubles and copecs, and exchange by the ruble, which is 4s. 5d. sterling at par, but the course runs from 4s. to 5s.

Russia exchanges with Hamburg about 110 copecs per R. lubs, and with Holland about 50 stivers per ruble.

EXAMPLES.

1st, In 2586 rubles, how many pounds sterling, exchange at 4s. 4d. sterling per ruble?

$4s. = \frac{1}{2} \mid 2586 \text{ at } 4s. \ 4d.$

517	4
43	2

L. 560 6 Ans.

2d, In (a) L. 712 10 6 sterling, how many rubles, exchange (b) 48 stivers per (c) ruble, and (d) 34s. 8d. Flemish, per (e) pound sterling?

d d d d
If $e : d :: a : q$

d rub d rubles

If $b : c :: q : 3087.6083$ Ans.

3d, In (a) 1675 rubles, how much Hamburg money, exchange (b) 110?

cop m c cop marc lubs

If $b : 3 :: a : 4568.18$ Ans.

4th, What is the value of 1785 rubles drawn on Holland, exchange 48 stivers per ruble, commission $\frac{1}{4}$ per cent. and from Holland on London, exchange 35s. 6d.?

$$\begin{array}{r}
 \text{rubles} \\
 1785 \\
 48 \\
 \hline
 \frac{1}{4} = 200) 85680 \\
 \quad 428 \quad 4 \\
 \frac{1}{4} = \frac{1}{4} \quad 214 \quad 2 \\
 \hline
 35s. 6d. = 213) 86322 \quad 6 \\
 \hline
 \text{L.409 } 19 \quad 3\frac{1}{2} \text{ Ans.}
 \end{array}$$

5th, A merchant in London remits to his correspondent at Petersburg L.450 15 sterling, exchange 34s. 6d. Flemish per pound sterling, for Amsterdam, and the exchange from thence at 50 stivers per ruble, how many rubles must the correspondent receive?

Ans. 1866 rubles, 10 copecs

6th, What is the value of 1650 rubles, drawn on Hamburg, exchange 110, commission $\frac{1}{4}$ per cent. and from Hamburg on London, exchange 34s. 9d.?

$$\begin{array}{r}
 \text{c} \quad \text{m} \quad \text{l} \quad \text{copecs} \\
 \text{If } 110 : 3 :: 165000 \\
 \quad \quad \quad 3 \\
 \hline
 110) 495000 \\
 \quad 4500 \\
 \hline
 \frac{1}{4} = 200 \quad 22.5 \\
 \frac{1}{4} = \frac{1}{4} \quad 11.25 \\
 \hline
 4533.75 \\
 \quad 32 \\
 \hline
 d \\
 34s. 9d. = 417) 145080.00 \\
 \hline
 \text{L.347.913669 Ans.}
 \end{array}$$

EXCHANGE WITH POLAND AND PRUSSIA.

MONEY TABLE.

18 penins	} make	1 gros
18 gros		1 oort
30 gros		1 florin, or Polish guilder
3 florins		1 rix dollar
2 rix dollars		1 gold ducat

Note, $13\frac{1}{2}$ florins = 1 pound sterling.

At Dantzic, accounts are kept in florins, gros, and penins, and exchange by the gros.

Exchange is made with Poland and Prussia, being from 240 to 295 groffi per pound Flemish.

EXAMPLES.

1st, In (a) L.480 16 8 sterling, how many Prussian flo-

rins, &c. exchange (b) 285 groffi per (c) pound Flemish, and (d) 34s. 2d. Flemish, per (e) pound sterling?

$$\begin{array}{r}
 L \quad d \quad f \quad L \\
 \text{If } c : d :: a : L821 \quad 8 \quad 5\frac{1}{2} \text{ Flemish} \\
 L \quad f \quad F \quad L \quad f \quad \text{florins} \quad \text{gr} \quad \text{pen} \\
 \text{If } c : b :: 821 \quad 8 \quad 5\frac{1}{2} : 7803 \quad 15 \quad 13\frac{1}{4} \text{ Ans.} \\
 2d, \text{ How much Polish in (a) L.600, exchange (b) } 13\frac{1}{2}d. \\
 \text{per (c) florin?}
 \end{array}$$

$$\begin{array}{r}
 d \quad f \quad d \quad \text{florins} \\
 \text{If } b : c :: a : 10666.6 \text{ Ans.}
 \end{array}$$

3d, How much Polish in (a) 3560 marc lubs, exchange (b) 108 gros per (c) rix dollar banco?

$$a \times b \div 90 = 4272 \text{ dollars Ans.}$$

Note, 90 groffi = 1 rix dollar.

4th, In (a) 7000 florins, 15 gros, Polish, how many pounds sterling, exchange (b) 280 Polish groffi per (c) pound Flemish, and (d) 33s. 4d. Flemish per (e) pound sterling?

$$\begin{array}{r}
 g \quad L \quad g \quad L \quad f \\
 \text{If } b : c :: a : q \\
 L \quad f \quad L \quad L \quad f \\
 \text{If } d : e :: q : L450 \quad 0 \quad 7\frac{1}{2}
 \end{array}$$

5th, In (a) L.800 13 4 sterling, how many rix dollars, &c. Polish, exchange (b) 260 groffi Polish per (c) pound Flemish, and (d) 34s. 8d. Flemish per (e) pound sterling?

$$\begin{array}{r}
 d \quad d \quad f \quad d \quad L \quad f \\
 \text{If } e : d :: a : q \\
 L \quad f \quad \text{gr} \quad L \quad f \quad \text{rix dollars} \\
 \text{If } c : b :: q : 4009.26419 \text{ Ans.}
 \end{array}$$

6th, In L.585 16 8 sterling, how many gold ducats, exchange 290 groffi per pound Flemish, and 34s. 5d. Flemish, per pound sterling?

Ans. 1624.19579 ducats.

CRITERION.

L.785 + 3896 guild. banco + 5689 marks banco + 5689 livres + 5769 milrees + 68796 rials plate + 7689 pezzos + 8968 florins, reckoning $13\frac{1}{2}$ florins to the pound sterling, valuing the whole at par.

Ans. L.7355 4 11 $\frac{1}{2}$

EXCHANGE WITH SWEDEN.

MONEY TABLE.

8 pennins	} make	1 runstychen
3 runstychens		1 stiver or whitton
8 stivers		1 marc
10 stivers and 2 runstychens		1 copper dollar
or 32 runstychens		
3 copper dollars & 32 stivers,	} make	1 silver dollar
or 96 runstychens, or 4		
marcs		
24 marcs		1 copper rix dollar

At Stockholm, accounts are kept in copper dollars and oorts, or in silver dollars, and exchange by the copper dollar. The exchange is usually from 46 to 50 copper dollars per pound sterling, but is very variable.

EXAMPLES.

1st, In (a) L.200 15 10 sterling, how many dollars, exchange (b) 48 copper dollars per (c) pound sterling?

$L \quad c d \quad L \quad c \text{ dollars}$

If $c : b :: a : 9638 \text{ Ans.}$

2d, In (a) L.368 10 sterling, how many marcs, &c. exchange (b) 49½ copper-dollars per (c) pound sterling?

$L \quad s d \quad L \quad \text{marcs}$

If $c : b :: a : 24321 \text{ Ans.}$

3d, In (a) L.640 sterling, how many silver dollars, exchange (b) 48½ copper dollars per (c) pound sterling?

$L \quad c d \quad L \quad c d \quad \text{fil. dol.}$

If $c : b :: a : 31040 \div 3 = 10346.6 \text{ Ans.}$

4th, In 1630 silver dollars, how many pounds sterling, exchange 49 copper dollars per pound sterling?

$L.99 \ 15 \ 11 \text{ Ans.}$

CRITERION.

L.1045 + 2569 guilders banco + 376 livres + 2883 milrees + 7560 rial plate + 3756 marks banco + 2800 pezzos + 4736 florins + 3765 silver dollars, ex. 41d. per copper dollar, valuing the whole at par.

$L.5466 \ 10 \ 0\frac{1}{4} \text{ Ans.}$

EXCHANGE WITH DENMARK AND NORWAY.

MONEY TABLE.

16 schillings	} make	1 marc
6 marcs		1 rix dollar
4 do.		1 ort
11 do.		1 ducat

EXAMPLES.

1st, In (a) L.1000 sterling, how many rix dollars, exchange (b) 4 rix dollars per (c) pound sterling?

$L \quad r d \quad L \quad \text{rix doll.}$

If $c : b :: a : 4000 \text{ Ans.}$

2d, In (a) 21050 guilders current, how many (b) rix dollars, agio (b) 3½ per (c) cent. exchange (d) 110½?

If $c + b : c :: a : q$

$2\frac{1}{2} : 1 :: q : r. d. \text{ Danish}$

$c : c + d :: r. d. : 8989.4685985 \text{ rix dol. banco}$

3d, In (a) 4900 rix dollars, how many current guilders, exchange (b) 108, agio (c) 3 per (d) cent?

If $b : d :: a : q \times 2\frac{1}{2} = p$

If $d : d + c :: p : 11682.870275 \text{ guild. cur. Ans.}$

EXCHANGE WITH AMERICA AND THE WEST INDIES.

In America accounts are kept by many in dollars and cents, 100 cents being equal to 1 dollar, the par of which is 4s. 6d.; but bills are commonly negotiated in pounds, shillings, and pence. The sums of the invoices are often made out both ways.

EXAMPLES.

1st, In (a) L.496 16 8 sterling, how much currency will that amount to, exchange at (b) 80 per (c) cent?

If $c : b + 100 :: a : L.894 \ 6 \text{ Ans.}$

2d, The nett proceeds of a cargo from Britain to Boston amount to L.674 19 6 currency, how much is that in sterling money, exchange at 75 per cent?

$\text{Ans. } L.385 \ 14 \text{ sterling.}$

3d, Philadelphia grants a bill on Britain for L.800 13 4 sterling, what is the value of the bill in currency, exchange at 80 per cent?

$\text{Ans. } L.1441 \ 4 \text{ currency.}$

4th, How much currency in Virginia will purchase a bill of L.450 6 8 sterling, when exchange is 33 per cent?

$\text{Ans. } L.598 \ 18 \ 10\frac{1}{4} \text{ currency}$

5th, How much sterling money will L.1650 Jamaica currency amount to, exchange at 30 per cent?

$\text{Ans. } L.1269 \ 4 \ 7\frac{1}{4} \text{ sterling}$

6th, A parcel of goods from Britain, amounting, by invoice to L.484 17 6 sterling, are sold by a factor in Virginia for L.703 13 9 currency, what sterling ought the factor to remit, deducting 3 per cent. for commission, and how much does the employer gain per cent, when the exchange is at 35 per cent?

If $135 : 100 :: 703.6875 : L.521.25$ what the factor ought to remit

$L.484.875$

$L.484.875 : L.36.375 :: L.100 : 7\frac{1}{2} \text{ Ans.}$

EXCHANGE WITH IRELAND.

Accounts are kept in pounds, shillings and pence Irish, which are inferior to sterling. Their real coins of gold and silver are the same as the British, but they have halfpennies and farthings of their own.

A shilling sterling = 13d. currency, consequently L.1 sterling = L.1 1 8 currency, and a guinea passes for L.1 2 9. The value of L.100 sterling at par is L.108 6 8 Irish. The course of exchange varies from 6 to 12 per cent.

Note, The several towns in Britain exchange with London for a small premium in favour of London, such as 1, 1½, &c. per cent. The premium is more or less according to the demand for bills; but, instead of paying premium, it is usual to draw bills payable at a certain number of days, accounting 73 days equal to 1 per cent.

EXAMPLES.

1st, How much Irish in L.750 12 6, exchange 8½ per cent?

$\text{Ans. } L.813 \ 3 \ 6 \text{ Irish}$

2d, In L.813 3 6 Irish, how much sterling at par?

$\text{Ans. } L.750 \ 12 \ 6$

EXCHANGE WITH TURKEY.

1 asper nearly ½ of 1d.

1 piaſtre = 80 aspers.

EXCHANGE WITH THE EAST INDIES.

MONEY TABLE.

10 fanams,	} make	{	1 rupee =	s	d
36 do			1 pagoda =	2	6 sterling
1 lack of rupees			100,000	8	9
1 crore of do.			100 lacks		

OF DRAWING AND REMITTING OF MONEY.

On account of the variableness of the exchange of money, a wide field is open for the speculator, which may be attended with loss or advantage according to circumstances. The less value the speculator's money is in his own country, the more he will lose by remitting, or profit by drawing; and the greater the value of his own money in another country, the more he will lose by remitting, so that when the exchange is low, it is better to draw than to remit, and when it is high, better to remit than draw.

EXAMPLES.

1st, Edinburgh owes Ireland (a) L.5760 sterling, when the exchange is (b) 8 per (c) cent. what sum should be remitted should the exchange rise to (d) 12 per cent.?

$$\text{If } c+d : a :: b+c : 5554 \quad 5 \quad 8\frac{1}{2} \text{ Ans.}$$

2d, What is gained or lost by remitting (a) L.860 sterling to Paris, when the exchange is (b) 30d. and drawing when the exchange is (c) 35d?

$$\text{If } b : a :: c : 1003 \quad 6 \quad 8 - a = 143 \quad 6 \quad 8 \text{ gain}$$

3d, When the exchange with Ireland was at (a) 12 per (b) cent. a merchant in Edinburgh drew for (c) L.1000, what did he gain or lose by remitting when the exchange is at (d) 8 per cent?

$$\text{If } b+d : c :: b+a : 1037 \quad 0 \quad 8\frac{1}{2} - c = 37 \quad 0 \quad 8\frac{1}{2} \text{ loss}$$

4th, London drew on Hamburg for (a) L.920, exchange (b) 36s. 6d. what was gained or lost by replacing the draught when the exchange fell to (c) 34s. 2d?

$$\text{If } c : a :: b : 982 \quad 16 \quad 7 - a \times 62 \quad 16 \quad 7 \text{ loss}$$

5th, Britain owes Jamaica (a) L.400 sterling, exchange (b) 110 per cent. how much sterling will pay the draught when the exchange is (c) 106 per cent?

$$\text{If } c : a :: b : 415 \quad 1 \quad 10\frac{1}{2} \text{ Ans.}$$

6th, Britain drew on Amsterdam for (a) L.8000, exchange (b) 36s. 3d. but was obliged to replace the draught when the exchange was at (c) 34s. 6d. what was lost or gained on the whole, and how much (d) per cent?

$$\text{If } c : a :: b : 8405.797 - a = 405 \quad 15 \quad 11\frac{1}{2} \text{ loss}$$

$$\text{If } a : 405.797 :: d : 5.0724625 \text{ loss per cent.}$$

ARBITRATION OF EXCHANGE.

When the rates of exchange between two or more places are given to find the rate of exchange between the first and last in correspondence to the rest, make two columns of the given terms, and let no two terms of the same kind be in a column; then multiply that column which has the odd term in it for a dividend, and multiply the other for a divisor, the quotient thence arising will be the answer.

EXAMPLES.

1st, If exchange from London to Amsterdam be (a) 33s. 6d. per (b) pound sterling, and if exchange from London to Paris be (c) 32½d. per crown, what must be the rate of exchange from Amsterdam to Paris, in order to be on par with the other two?

$$d \quad d \quad d$$

$$\text{If } b : a :: c : 54d. \quad \frac{7}{8} \text{ Flemish per crown Ans.}$$

2d, If exchange from Paris to London be (a) 32½d. sterling per crown, and if exchange from Paris to Amsterdam be (b) 54d. $\frac{7}{8}$ Flemish per crown, what must be the rate of exchange between London and Amsterdam in order to be on par with the other two?

$$\text{If } a : b :: 240 : 33s. \quad 6d. \text{ Ans.}$$

3d, If exchange from Amsterdam to Paris be (a) 54d. $\frac{7}{8}$ Flemish per crown, and if exchange from Amsterdam to London be (b) 33s. 6d. Flemish per (c) pound sterling, what must be the rate of exchange between Paris and London, in order to be on par with the other two?

$$\text{If } b : c :: a : 32\frac{1}{2}d. \text{ sterling per crown Ans.}$$

4th, London was ordered to remit to Paris 1000 crowns, at (a) 32d. sterling per crown, and to draw for the value upon Amsterdam at (b) 36s. 6d. Flemish per pound sterling, but when the order came up, bills on Paris were at (c) 32½d. sterling per crown, what must be the rate of exchange with Amsterdam to compensate the advance on the remittance?

$$\text{If } c : b :: a : 36 \quad 2\frac{1}{2} \quad \frac{54}{100} \text{ Ans.}$$

5th, London was ordered to remit (a) 600 ducats to Venice at (b) 51d. sterling per ducat, and to draw for the value upon Spain at (c) 42d. sterling per piastre, but when the order came to hand, bills on Venice were at (d) 53d. at what rate of exchange must London draw upon Spain, to compensate the advance upon the remittance?

$$\text{If } b : d :: c : 43\frac{1}{2} \quad \frac{53}{51} \text{ Ans.}$$

6th, If London remit (a) L.1000 sterling to Spain by way of Holland at (b) 34s. Flemish per (c) pound sterling, thence to France at (d) 56d. Flemish per (e) crown, thence to Venice at (f) 100 crowns per (g) 60 ducats, and thence to Spain at (h) 350 mervadies per (i) ducat, how many piastres of (j) 274 mervadies will the (k) L.1000 sterling amount to in Spain?

$$\begin{array}{c} c \\ d \\ f \\ i \\ j \end{array} \quad \begin{array}{c} b \\ e \\ g \\ h \\ i \\ a \end{array}$$
 how many piaftres
 $c \times d \times f \times i \times j = 1534400$
 $b \times e \times g \times h \times a = 8568000000$
 $8568000000 \div 1534400 = 5583 \frac{221}{877}$ piaftres *Ans.*

7th, A banker in Amsterdam remits to London (a) L.500 Flemish, first to France at (b) 58d. Flemish per (c) crown, from France to Venice at (d) 100 crowns per (e) 60 ducats, from Venice to Hamburgh at (f) 98d. Flemish per (g) ducat, from Hamburgh to Lisbon at (h) 50d. Flemish per (i) cruſado of (j) 400 rees, and from Lisbon to London at (k) 66d. ſterling per (l) milree, how much ſterling money will the remittance amount to, and how much will be gained ſuppoſe the direct exchange from Holland to London at (m) 36s. 6d. Flemish per (n) pound ſterling?

$$\begin{array}{c} b \\ d \\ g \\ h \\ \text{rees l} \end{array} \quad \begin{array}{c} c \\ e \\ f \\ j \\ k \\ a \end{array}$$
 how many pounds ſterling in
 $b \times d \times g \times h \times l = 290000000$
 $c \times e \times f \times j \times k \times a = 1862784000000$
 $1862784 \div 29 = 64233 \frac{1}{4}d. = L.267 \ 12 \ 9 \frac{1}{4}$ *Ans.*
 If m : n :: a : L.273 19 5 $\frac{1}{4}$

Gained L. 6 6 7 $\frac{1}{2}$

8th, A merchant at London has credit for (a) 700 piaſtres at Leghorn, for which he can draw directly at (b) 52d. ſterling per (c) piaſtre, but chuſing to try the circular way, they are by his order remitted firſt to Venice at (d) 95 piaſtres per (e) 100 ducats banco, thence to Cadiz at (f) 350 mervadies per (g) ducat, thence to Liſbon at (h) 630 rees per piaſtre of (i) 272 mervadies, thence to Amſterdam at (j) 48d. Flemish per (k) cruſado of (b) 490 rees, thence to Paris at (m) 54d. Flemish per (n) crown, thence to London at (o) 30d. ſterling per (p) crown, what is the arbitrated price between London and Leghorn per (q) piaſtre, and how much is the circular remittance better than the direct draught, without reckoning charges?

$$\begin{array}{c} d \\ g \\ i \\ l \\ m \\ p \end{array} \quad \begin{array}{c} e \\ f \\ h \\ j \\ n \\ o \end{array}$$
 1st p $\div$ 2d p = 56 $\frac{287}{111}$ ſhill. per piaſtre
 If q : 56 $\frac{287}{111}$:: a : L.165 18 5 $\frac{1}{4}$
 : b :: a : 151 13 4

Gained L.14 5 1 $\frac{1}{4}$

ALLIGATION MEDIAL.

Alligation Medial is when the quantities and prices of ſeveral things are given, to find the mean price of the mixture compounded of thoſe things.

RULE.

As the whole compoſition is to it's total value, ſo is any part of the compoſition to it's mean price.

Find the value of the whole mixture at the mean rate, and if it agrees with the total value of the ſeveral quantities at their reſpective rates, the work is right.

EXAMPLES.

1st, A farmer mingled (a) 30 buſhels of oats at (b) 2s. 6d. per buſhel, and (c) 40 buſhels of rye at (d) 4s. 6d. per buſhel, and (e) 6 buſhels of barley at (f) 3s. 6d. per buſhel, I demand what a buſhel of this mixture is worth?

$a \times b = p$
 $c \times d = p$
 $e \times f = p$
 $s \div s = Lo \ 3 \ 7 \frac{1}{2} \frac{6}{7}$ *Ans.*

2d, A vintner mingled (a) 6 gallons of canary at (b) 12s. per gallon, and (c) 4 gallons of malaga at (d) 10s. per do. and (e) 14 gallons of white wine, at (f) 8s. per do. together, I demand what a gallon of this mixture is worth?

$a \times b = p$
 $c \times d = p$
 $e \times f = p$
 $s \div s = 9s. \ 4d.$ *Ans.*

3d, A farmer mingled 30 buſhels of wheat at 7s. per buſhel, and 30 buſhels of beans at 2s. 6d. per buſhel, and 60 buſhels of peaſe at 3s. 6d. per buſhel together, I demand what a buſhel of this mixture is worth?

Ans. 4s. 1 $\frac{1}{2}$ d. per buſhel

ALLIGATION ALTERNATE

Is when the rates of ſeveral things are given to find ſuch quantities of them as are neceſſary to make a mixture, which may bear a certain rate propounded.

Link the ſeveral rates together in ſuch fort, that one greater than the mean rate may be coupled to another which is leſs.

Take the differences between the mean rate and the ſeveral prices, and place them each againſt its yoke fellow.

EXAMPLES.

1st, A grocer would mix three ſorts of ſugar together, viz. one ſort at 11d. per lib. another at 8d. and another at 6d. how much of each ſort muſt be taken, that the whole mixture may be ſold for 7d. per lib?

$$7 \left| \begin{array}{r} 11 \\ 8 \\ 6 \end{array} \right) \begin{array}{l} 1 \text{ at } 11d. \\ 1 \text{ at } 8d. \\ 5 \text{ at } 6d. \end{array} \} \text{Ans.}$$

2d, A grocer hath several sorts of tea, viz. one sort at 15s. per lib. another at 12s. a third at 7s. and a fourth at 5s. I demand how much of each sort he must mix together that the whole quantity may be afforded at 8s. per lib?

$$8 \left| \begin{array}{r} 15 \\ 12 \\ 7 \\ 5 \end{array} \right) \begin{array}{l} 1 \text{ at } 15s. \\ 3 \text{ at } 12s. \\ 7 \text{ at } 7s. \\ 4 \text{ at } 5s. \end{array} \} \text{Ans.}$$

3d, An innkeeper would with 70 bushels of his best corn, at 65d. per bushel, mix other corns at 50d. at 45d. at 42d. at 36d. per bushel, what quantity of the last three must he take, that the mixture may be worth 46d. per bushel?

Ans. 1 lib. at 65d. 14 lbs. at 50d. 19 lbs. at 45d. 4 lbs. at 42d. and 4 lbs. at 36d.

ALTERNATION PARTIAL.

When the rates of all the things, the quantity of but one of them, and the mean rate of the whole mixture are given to find quantities of the rest in proportion to the quantity given, take the difference between each price and the mean rate, and place them alternately.

RULE.

As the difference of the same name with the quantity given, is to the rest of the differences severally, so is the quantity given, to the several quantities required.

EXAMPLES.

1st, A man being determined to mix 12 bushels of wheat at 4s. per bushel, with rye at 3s. 6d. with barley at 2s. 6d. and with oats at 1s. 3d. per bushel, I demand how much rye, barley, and oats, must be mixed with the 12 bushels of wheat, that the whole may be sold at 2s. 2d. per bushel?

$$26 \left| \begin{array}{r} 48 \\ 42 \\ 30 \\ 15 \end{array} \right) \begin{array}{l} 11 \\ 11 \\ 11 \\ 11 \end{array} \} \begin{array}{l} 22 + 16 + 4 = 42 \\ \text{bush } p \end{array}$$

If 11 : 11 :: 12 : 12 0 of rye
11 : 11 :: 12 : 12 0 of barley
11 : 42 :: 12 : 45 3 $\frac{1}{4}$ of oats

2d, A man being determined to mix 10 bushels of oats at 1s. 6d. per bushel, with barley at 2s. with rye at 3s. 4d. and with wheat at 4s. 6d. per bushel, I demand how much barley, rye, and wheat, must be mixed with the 10 bushels of oats, that the whole may bear the price of 28d. per bushel?

$$28 \left| \begin{array}{r} 18 \\ 24 \\ 40 \\ 54 \end{array} \right) \begin{array}{l} 12 \\ 26 \\ 10 \\ 4 \end{array}$$

$$\begin{array}{l} \text{If } 12 : 26 :: 10 : 21 \text{ } 2\frac{1}{2} \text{ of barley} \\ \text{If } 12 : 10 :: 10 : 8 \text{ } 1\frac{1}{2} \text{ of rye} \\ \text{If } 12 : 4 :: 10 : 3 \text{ } 1\frac{1}{2} \text{ of wheat} \end{array}$$

ALTERNATION TOTAL.

When the rates of the several things, the quantity to be compounded, and the mean rate of the whole mixture are given, to find how much of each sort will make up the quantity, place the difference between the several prices and the mean rate alternately.

RULE.

As the sum of the difference
Is to the whole composition,
So is the difference of each rate
To the quantity of the same rate.

EXAMPLES.

1st, A grocer hath 4 sorts of sugar, viz. at 1s. at 10d. at 9d. and at 7d. per pound, and he would have a composition of an cwt. worth 8d. per lib. I demand how much of each sort he must take?

$$8 \left| \begin{array}{r} 12 \\ 10 \\ 9 \\ 7 \end{array} \right) \begin{array}{l} 1 \\ 1 \\ 1 \\ 1 \end{array} \} \begin{array}{l} 4 + 2 + 1 = 7 \\ \text{lib oz dr} \end{array}$$

If 10 : 112 :: 1 : 11 3 $\frac{3}{10}$ at 1s.
: 112 :: 1 : 11 3 $\frac{3}{10}$ at 10d.
: 112 :: 1 : 11 3 $\frac{3}{10}$ at 9d.
: 112 :: 7 : 78 6 $\frac{4}{10}$ at 7d.

112 0 0 proof

2d, A brewer hath 3 sorts of ale, viz. at 1s. at 9d. and at 4d. per gallon, and he would have a composition of 20 gallons, worth 6d. per gallon, I demand how much of each sort he must have?

$$6 \left| \begin{array}{r} 12 \\ 9 \\ 4 \end{array} \right) \begin{array}{l} 2 \\ 2 \\ 6 \end{array} \} \begin{array}{l} 2 \\ 2 \\ 9 \end{array}$$

If 8 : 20 :: 2 : 3 $\frac{1}{4}$ at 1s.
: 20 :: 2 : 3 $\frac{1}{4}$ at 9d.
: 20 :: 9 : 13 $\frac{1}{4}$ at 4d.

20 proof

SINGLE POSITION

Teacheth to resolve those questions the results of which are proportionable to their propositions.

RULE.

Take any number and perform the same operations with it, as are described to be performed in the question, then say, as the result of the operation is to the position, so is the result in the question, to the number required.

EXAMPLES.

1st, A person having about him a certain number of crowns, said, if the third, fourth, and fifth of them were added together, they would make $78\frac{1}{3}$ crowns, I demand how many he had?

Suppose 60, then $\frac{1}{3}$ of 60 is 20

$$\begin{array}{r} 15 \\ \frac{1}{4} \\ 12 \end{array}$$

$$47 : 60 :: 78\frac{1}{3} : 100 \text{ Ans.}$$

$$\begin{array}{r} \frac{1}{3} \text{ of } 100 = 33\frac{1}{3} \\ \frac{1}{4} \\ = 25 \\ \frac{1}{5} \\ = 20 \end{array}$$

78 $\frac{1}{3}$ proof

2d, Suppose the sum of L.30 was to be paid by A, B and C, in the following proportion, viz. $A \frac{1}{2}$, $B \frac{1}{3}$, and $C \frac{1}{4}$, what must each pay?

Suppose 30 then $\frac{1}{2}$ of 30 is L.15

$$\begin{array}{r} 10 \\ \frac{1}{3} \\ 7 \quad 10 \end{array}$$

32 10 result

L s d

$$\text{If } 32 \quad 10 : 15 :: 30 : 13 \quad 16 \quad 11 \frac{1}{3} \text{ A's}$$

$$32 \quad 10 : 10 :: 30 : 9 \quad 4 \quad 7 \frac{1}{3} \text{ B's}$$

$$32 \quad 10 : 7 \quad 10 :: 30 : 6 \quad 18 \quad 5 \frac{1}{4} \text{ C's}$$

3d, A schoolmaster being asked how many scholars he had, answered, if I had as many, half as many, and one third as many, I should have 68, how many had he?

Ans. 24 scholars

4th, A, B and C, discoursing of their age, B says to A, I am as old, and half as old again as you; says C to B, I am twice as old as you; and A affirms that the sum of their three ages amounted to, 132, what was each man's age?

Ans. A 24 years old

B 36

C 72

5th, A, B and C, buy a quantity of wine for L.153, of which A pays three times more than B, and B four times more than C, what paid each?

Ans. A paid L.108

B 36

C 9

6th, One man carrying a bag of money in his hand, another asked him how much was in it? He answered he could not tell, but the third, fourth and fifth of it made L.188. How much was in the bag?

Ans. L.240

7th, A man overtaking a maid driving a flock of geese, said to her, How do you do, sweetheart?—where are you going with these 40 geese?—No, Sir, said she, I have not

40, but if I had as many more, and one fourth as many more, and 4 geese beside, I should have 40; how many had she?

Ans. 16 geese

8th, Divide L.300 between two men, and give the one L.82 more than the other.

Ans. 109 191

9th, A person bought a chaise, horse and harness for L.80, the horse came to twice the price of the harness, and the chaise to twice the price of the horse and harness, what did he give for each?

Suppose the harness is L. 8

Then the horse price will be 16

And the chaise 48

$$\begin{array}{r} 72 \\ \text{If } 72 : 8 :: 80 : L8 \quad 17 \quad 9\frac{1}{2} \text{ harness} \\ : 16 :: 80 : 17 \quad 15 \quad 6\frac{1}{2} \text{ horse} \\ : 48 :: 80 : 53 \quad 6 \quad 8 \text{ chaise} \end{array}$$

L80 o o proof

DOUBLE POSITION

Teacheth to resolve questions by making two suppositions of false numbers.

1st, Take any two convenient numbers and proceed with each of them according to the conditions of the question.

2d, Find how much the results are different from the result in the question.

3d, Multiply each of the errors by the contrary supposition, and find the sum and difference of the products.

4th, If the errors are alike, divide the difference of the products by the difference of the errors, and the quotient will be the answer.

5th, If the errors are unlike, divide the sum of the products by the sum of the errors.

Note, The errors are to be alike, when they are both too great, or both too little; and unlike, when one is too great, and the other too little.

EXAMPLES.

1st, A, B and C, built a house, which cost L.120, of which A paid a sum unknown, B paid L.10 more than A, and C paid as much as A and B, what did each partner pay?

Position 1st A 6 Position 2d A 9

B 16 B 19

C 22 C 28

Result 44

120

Error 76

9

684

384

56 Result

120

64 Error

6

384

12)300

$$25 + 10 = 35 + 25 = 60$$

A B C L

$$25 + 35 + 60 = 120 \text{ proof}$$

2d, A father dying left L.600 to his three sons, dividing it as follows: The first must have a certain portion; the second must have twice as much as the first, wanting L.10; and the third must have three times as much as the first, wanting L.20, what was each son's share?

Ans. $\left\{ \begin{array}{l} \text{The first L.105} \\ \text{The second 200} \\ \text{And the third 295} \end{array} \right.$

L.600 proof

3d, A, B and C, discoursing of their ages, A affirmed that he was 16 years old, B said his age was equal that of A and half the age of C, and C affirmed he was as old as both A and B. What was the age of each person?

Ans. $\left\{ \begin{array}{l} A \ 16 \\ B \ 48 \\ C \ 64 \end{array} \right\}$ years old

4th, One being asked to lend his neighbour 150 guineas, made answer, that he had not so many, but if $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, and $\frac{1}{5}$ of his guineas were added together, they would just make 150. Required the number?

Ans. 90 guineas

5th, A and B had each a certain number of crowns, and said A to B if you give me one of yours I shall then have five times as many as you have behind, but said B to A, if you give me one of your crowns, then shall each of us have an equal number. How many crowns had each person?

Ans. A had 4, and B 2

6th, The money staked by A, B and C, playing at hazard was 400 crowns, but they happening to disagree, each seized as many of the crowns as he could, A got a number unknown, B as many as A and 12 over, C got a fourth part of both their sums added together. How many crowns got each?

Ans. A 154, B 166, and C 80

7th, A gentleman coming in to a garden meets with some ladies; says to them, Good morning to you 16 fair maids—Sir, you mistake (answered one of them) we are not 16, but if we were thrice as many as we are, we should be as many above 16, as we are now under.—How many were they?

Ans. 8

8th, A stealing apples was caught by B, and to make friends with him, gave half of all he had, and gets back 16; A going further meets with C, who extorted from him half of all he had left, but afterwards returns him 6; a little thereafter D comes up with him, who plundered him of the half of the apples he had remaining, and afterwards returns him 2; after which he had just 16. How many had he at first?

Ans. 56 apples

9th, Three beggars, upon a festival, had 243 sixpences thrown among them, of which each seized as many as he could; upon comparing circumstances it was found that B

had scrambled $11\frac{1}{4}$ more than A, and C had $\frac{1}{2}$ of the sum seized by the other two. Required the particulars?

Ans. 95.625 to A, 106.875 to B, and 40.5 to C

10th, A man, his wife, and son's years make 96, of which the father and son's equal the wife's and 15 years over, and the wife's and son's equal the man's and 2 years over, what was the age of each?

Ans. the man's 47, the wife $40\frac{1}{2}$, and son $8\frac{1}{2}$ years

11th, A father at his death left by his will L.1600 to be divided between his son and daughter in such a manner, that $\frac{1}{2}$ part of his share should exceed $\frac{1}{4}$ part of hers by L.10. How must the L.1600 be divided?

1st suppose his share is 600

and hers 440

2d, 700

520

1040

1220

1600

1600

560

380

560

380

700

600

180

392000

228000

228000

$$180 \left\{ \begin{array}{l} 3) 164000 \\ \hline 6) 54666 \end{array} \right.$$

5)911.1 son's share

182.2

10

172.2

4

688.8 daughter's share

12th, A son asked his father how old he was, his father replied, your age is now $\frac{1}{2}$ of mine, but four years ago your age was only $\frac{1}{4}$ of what mine is now. What were their ages?

Suppose the father $35 \div 7 = 5$ and the son $7 - 4 = 3$

2 first error

Again suppose the father $70 \div 7 = 10$ } 70 years } Ans.
and the son $14 - 4 = 10$ } 10

13th, An ancient lady being asked how old she was, to avoid a direct answer said, I have 9 children, and there are 3 years between the birth of each of them, the eldest was born when I was 19 years old, which is now the age of the youngest. How old was the lady?

Ans. 62 years

ARITHMETICAL PROGRESSION

Is when a rank or series of numbers increase or decrease, by a common difference, or by a continual adding or subtracting some equal numbers.

As $\{ 1, 2, 3, 4, 5, 6, 7, 8, \}$ here the common difference is 1
 $\{ 8, 7, 6, 5, 4, 3, 2, 1, \}$ is 1

Or, 1, 3, 5, 7, 9, 11, 13, here the common difference is 2

Also, 35, 30, 25, 20, 15, 10, 5, here the common difference is 5

In Arithmetical Progression, there are five things to be observed, viz.

- 1 The first term
- 2 The last term
- 3 The number of terms
- 4 The common excess or difference
- 5 The aggregate, or sum of all the terms.

Any three of which being given, the other two may be found.

CASE 1.

When the two extremes and the number of terms are given, to find the sum of all the series or terms, multiply the sum of the two extremes into the number of terms, and divide the product by 2, the quotient will be the sum of all the series; or, multiply the sum of the two extremes by half the number of terms.

EXAMPLES.

1st, How many strokes does the clock at Venice (which goes on to (a) 24 o'clock) strike in the compass of a natural (b) day?

$$1 + a \times b \div 2 = 300 \text{ strokes, } \text{Ans.}$$

2d, A butcher buys (a) 100 sheep, and gave for the (b) first sheep (c) 1s. and for the last (d) L.9 19, I demand what he gave for the 100 sheep?

$$c + d \times a \div 2 = \text{L.500 } \text{Ans.}$$

CASE 2.

Given the two extremes and number of terms to find the common difference.

The difference of the two extremes divided by the number of terms less than unity, the quotient will be the common difference.

EXAMPLES.

1st, One had (a) 20 children that differed alike in their ages, the youngest was (b) 5 years old, the oldest (c) 43, what was the difference of their ages, and the age of each?

Here $c - b = 38$ the difference of the extremes

And $a - 1 = 19$ the number of terms less 1

Also $38 \div 19 = 2$ common difference

Which add to the age of the youngest, and so on continually to the rest, will give their several ages, viz.

$5 + 2 = 7$ the age of the second

$7 + 2 = 9$ the age of the third

And so on for the rest.

2d, A running footman (for a wager) is to travel from London to a certain place northwards in (a) 19 days, and to go but (b) 6 miles the first day, encreasing every day's journey by an equal excess, so that the last day's journey may be (c) 60 miles; I demand each day's journey, and the distance of the place he goes to is from London?

$c - b = 54$ the difference of the extremes

$a - 1 = 18$ the number of terms less 1

$54 \div 18 = 3$ the common difference

$\frac{3}{2}$ miles for the 2d day

$\frac{3}{2}$ do. for the 3d day, and so on for all the rest

The distance from London to the place he goes to is 627 miles.

CASE 3.

When the two extremes and the common difference are given to find the number of terms, divide the difference of the two extremes by the common excess or difference, add unity, or 1 to the quotient, and the sum will be the number of terms.

EXAMPLES.

1st, A man being asked how many children he had, answered, my youngest child is (a) 5 years old, and the eldest (b) 43, and that he had increased one in his family every (c) 2 years. How many children had he?

$$b - a = 38$$

$$38 \div 2 = 19 + 1 = 20 \text{ children, } \text{Ans.}$$

2d, A person travelling from London northward, went 6 miles the first day, and encreased every day's journey 3 miles, till, at last, he went 60 miles in one day. How many days did he travel?

Ans. 19 days

CASE 4.

When the last term, the common difference, and the number of terms are given, to find the first term.

Multiply the number of terms less, unity or 1 by the common difference, the product subtracted from the last term leaves the first.

EXAMPLES.

1st, A person takes out of his pocket at (a) 10 different times, so many different number of guineas, every one exceeding the former by 2, the last was (b) 23, what was the first?

$$a - 1 = 9$$

$$\frac{2}{2}$$

$$b - 18 = 5 \text{ guineas, } \text{Ans.}$$

2d, A man in 19 days went from London to a certain place in the country, every day's journey was greater than the preceding one by 3 miles, his last day's journey was 60 miles, what was the first?

Ans. 6 miles

CASE 5.

When the number of terms, common difference, and the sum of all the terms are given to find the first term.

Divide the sum of all the series by the number of terms, and from that quotient subtract half the product of the common difference, multiplied by the number of terms less 1 gives the first term.

EXAMPLES.

1st, A man is to receive (a) L. 300 at (b) 12 different payments, each payment to exceed the former by (c) L. 4, he is willing to bestow the first payment on any one that can tell him what it is. What must the Arithmetician have for his pains?

$$\begin{array}{r} a \div b = 25 \\ b - 1 = 11 \times 4 = 44 \div 2 = 22 \end{array}$$

L. 3 Ans.

2d, A person is to receive L. 275 at 10 different payments, each payment to exceed the former by L. 5, he is willing to bestow the first payment on any one that can tell him what it is. What must the arithmetician have for his pains?

L. 5 Ans.

CASE 6.

When the first term, number of terms, and the common difference are given, to find the last term.

Subtract the common difference from the product of the number of terms multiplied by the common difference, the remainder added to the first term will give the last.

EXAMPLES.

1st, What is the last term of an arithmetical progression, beginning at (a) 1, and continuing by the increase of (b) 2 to (c) 100 places?

$$c \times b - b + a = 199 \text{ Ans.}$$

2d, What is the last term of an arithmetical progression, beginning at 4, and continuing by the increase of 12, to 18 places?

208 Ans.

CASE 7.

The first term, common difference, and number of terms given to find the sum of all the series.

From the product of the number in the common difference, subtract the common difference, and to the remainder add the double of the first term, half the product of that sum multiplied by the number of terms gives the sum of all the series.

EXAMPLES.

1st, A merchant has (a) 100 yards of superfine cloth, viz. the first yard for (b) 1s. the second for (c) 2s. the third for (d) 3s. &c. how much did he receive for the said cloth?

$$a \times b - b + c \div c \times a = L. 252 \text{ 10 Ans.}$$

2d, A gentleman bargains with a bricklayer to sink him

a well 30 yards deep, upon these terms, viz. to pay him 3s. for the first yard, 5s. for the second, 7s. for the third, &c. raising 2s. for every yard. What will be due to the bricklayer for completing the same?

L. 48 Ans.

CASE 8.

The first term, the number of terms, and the sum of all the terms given to find the common difference.

Divide the double of all the series by the number of terms, and from the quotient subtract double the first term; divide the remainder by the number of terms lessened by unity, the quotient will be the common difference.

EXAMPLES.

1st, A traveller went (a) 100 leagues in (b) 8 days, and every day he travelled equally farther than the preceding day; now, it being discovered that the first day he travelled (c) 2 leagues, the question is how many leagues he travelled on each of the other days?

$a \times c \div b - \frac{1}{2}$ of $b = 21$, also $b - 1 = 7$, then $21 \div 7 = 3$ common difference $3 + 2$, and every sum respectively gives

5	for the second
8	the third
11	fourth
14	fifth
17	sixth
20	seventh
23	eighth

100 proof

2d, A gentleman travelled (a) 200 miles in (b) 8 days, and every day he travelled equally farther than the preceding day; it is known that the first day he travelled (c) 6 miles, how many miles did he travel each of the other days?

$a \times 2 \div b - 12 = 38$, also $b - 1 = 7$, then $38 \div 7 = 5 \frac{1}{2} + 6$ and every other term respectively gives $11 \frac{1}{2}$ for the second

16 $\frac{1}{2}$	third
22 $\frac{1}{2}$	fourth
27 $\frac{1}{2}$	fifth
33 $\frac{1}{2}$	sixth
38 $\frac{1}{2}$	seventh
44	eighth

200 proof

GEOMETRICAL PROGRESSION

Is when any rank or series of numbers increase by one common multiplier, or decrease by one common divisor, as 2, 4, 8, 16, 32, 64; here the common multiplier, or ratio, is 2.

Also, 729, 243, 81, 27, 9, 3; here the common divisor, or ratio, is 3.

In Geometrical Progression the same five things are to be observed as in Arithmetical Progression, viz.

- 1 The first term
- 2 The last term
- 3 The number of terms
- 4 The ratio
- 5 The sum of the terms.

Any three of these being known, the rest may be found, if to any series of numbers in Geometrical Progression, when the first term is not an unit, or the same as ratio but not an unit, and there be assigned a series of numbers in Arithmetical Progression beginning an unit or 1, and whose common difference is 1, called indices or exponent

thus { 1, 2, 3, 4, 5, 6, 7 indices
2, 4, 8, 16, 32, 64, 128, numbers in Geometrical Progression.

CASE 1.

When the first term is unity, the ratio and number of terms given to find the last term.

Find a few of the leading terms, over which place their indices, then find what figures of the indices which added together will give the index of the term wanted. Multiply the numbers standing under such indices into each other, and the last product will be the term required.

Note, When the indices begin with a cypher, the sum of the indices made choice of must be always one less than the number of terms given in the question, as 1 in the indices stands over the second term.

EXAMPLES.

1st, A man bought a horse, and, by agreement was to give what the last nail would come to, at a farthing for the first nail, two for the second, four for the third, &c. There were 4 shoes, and 9 nails in each shoe, I demand the price of the horse.

0, 1, 2, 3, 4, 5, 6, 7, indices

1, 2, 4, 8, 16, 32, 64, 128, terms

$$7+7=14$$

$$128 \times 128 = 16384$$

$$14+14=28$$

$$16384 \times 16384 \times 128 = L.35791394 \quad 2 \quad 8 \text{ Ans.}$$

2d, A boy agrees for 16 oranges, to pay only the price of the last for the whole, reckoning a farthing for the first, an halfpenny for the second, &c. doubling the price to the last. How much did he give for them?

$$\text{Ans. } L.34 \quad 2 \quad 8$$

CASE 2.

In any series, not proceeding from unity, the ratio and first term being given, to find any remote term, without producing all the intermediate terms.

Proceed as in the last Case, only observe to divide every product by the first term, and the quotient will be the term required.

EXAMPLES.

1st, Suppose L. 100 to have been lent 20 years ago, at 5 per cent. per annum, but the interest never paid up, what will be the amount, allowing the interest to have been yearly added to the principal?

$$\begin{array}{ccccccccc} 0, & 1, & 2, & 3, & 4, & 5, & & & \\ 100, & 105, & 110.25, & 115.7625, & 121.55063, & 127.62816, & & & \\ & 6, & 7, & 8, & 9, & & & & \\ & 134.00957, & 140.71005, & 147.74555, & 155.13283, & & & & \\ & 10, & & & & & & & \\ & 162.88947 & & & & & & & \end{array}$$

$$10+10=20$$

$$162.88947 \times 162.88947 \div 100 = L.265.33000 \text{ Ans.}$$

2d, A person dying, left 11 children, to whom, and to his executor, he bequeathed in the manner following, viz. To his executor, for seeing his will performed, L.10; the youngest child to have L.30, and so on, every child to exceed the next younger in triple proportion. What will be the share of the eldest?

0, 1, 2, 3, 4, 5, 6, indices

10, 30, 90, 270, 810, 2430, 7290, terms

$$5+6=11$$

$$2430 \times 7290 \div 10 = L.1771470 \text{ the eldest child's fortune.}$$

CASE 3.

When the first term, ratio, and number of terms are given, to find the sum of the terms.

Find the last term as before, from which take the first, divide the remainder by the ratio less 1, and to that quotient add the last term, gives the sum required.

EXAMPLES.

1st, A corn merchant buys 12 stacks of wheat, and was to pay 2d. for the first stack, 6d. for the second, tripling the price for every following stack. What sum did he pay?

0, 1, 2, 3, 4, 5, 6,

2, 6 18, 54, 162, 486, 1458, $5+6=11$

$$486 \times 1458 \div 2 - 2 \div 2 + 354294 = L.2214 \quad 6 \quad 8 \text{ Ans.}$$

2d, On New Year's Day a gentleman married, and received of his father-in-law a guinea, on condition that he was to have a present on the first day of every month for the first year, which should be double still to what he had the month before. What was the young lady's portion?

0, 1, 2, 3, 4, 5, 6, indices

1, 2, 4, 8, 16, 32, 64, terms $6+5=11$

$$32 \times 64 - 1 \div 1 + 2048 = 4095 \text{ guineas, Ans.}$$

CASE 4.

Of any decreasing series in ∞ whose last term is a cypher, to find the sum of those series.

Divide the square of the first by the difference between the said first term, and the second term in the series, the quotient will be the sum of the series.

EXAMPLES.

1st, A great ship pursues a little one, steering the same way, at the distance of 4 leagues from it, and sails twice as fast as the small ship, 'tis asked how far the great ship must sail before it overtakes the lesser?

First, 4, 2, 1, $\frac{1}{2}$, $\frac{1}{4}$, &c.

$$4 \times 4 = 16, \text{ square of the first term}$$

$$16 \div 2 = 8 \text{ leagues, Ans.}$$

2d, Suppose a ball to be put in motion by a force which drives it (a) 12 miles the first hour (b) 10 the second, and so on, decreasing continually in proportion of (c) 12 to 10; to infinity, what space would it move through?

$$c - b = r$$

$$a \times a \div r = 72 \text{ miles, Ans.}$$

3d, Required the value of (a) .9?

$$a \times a = 81.9 - .09 = 81 \div 81 = 1 \text{ Ans.}$$

4th, Required the sum of $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}, \frac{1}{6}, \frac{1}{7}, \frac{1}{8}, \frac{1}{9}, \frac{1}{10}, \frac{1}{11}, \frac{1}{12}, \frac{1}{13}, \frac{1}{14}, \frac{1}{15}, \frac{1}{16}, \frac{1}{17}, \frac{1}{18}, \frac{1}{19}, \frac{1}{20}, \frac{1}{21}, \frac{1}{22}, \frac{1}{23}, \frac{1}{24}, \frac{1}{25}, \frac{1}{26}, \frac{1}{27}, \frac{1}{28}, \frac{1}{29}, \frac{1}{30}$ &c.?

$$\frac{1}{2} \div \frac{1}{2} = 1 \text{ Ans.}$$

PERMUTATION.

Permutation is the changing or varying the order of things in respect of their places.

Multiply all the given terms in a series of arithmetical progressionals continually, whose first term or common difference is 30, or 1, and the last of the number of things proposed to be varied, together, and the last product will be the number of changes or variations required.

EXAMPLES.

1st, Six gentlemen that were travelling, met together by chance, at a certain inn upon the road, where they were so pleased with their landlord, and each other's company, that in a frolic, they made a contract to stay at that place, as long as they, together with their landlord, could sit every day in a different order or position at dinner. Required the time they staid?

days

$$1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 = 5040 = 13 \frac{12}{13} \text{ years, Ans.}$$

2d, I demand the number of changes that may be rung on twelve bells, also in what time they may all be rung, allowing 3 seconds to every round, and 365 days, 6 hours, to a year?

$$1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9 \times 10 \times 11 \times 12 =$$

$$\begin{array}{ccccccc} \text{changes} & & \text{seconds} & & \text{ye} & \text{days} & \text{h} \\ 479001600 \times 31437004800 = & 45 & 195 & 18 & & & \end{array}$$

in ringing.

3d, An accomptant told a gentleman who had continually 8 persons at his table, that he would gladly make the ninth, and was willing to give 20 guineas for his board, so long as he would place the said company at dinner differently from any one day before. This being accepted, what did his entertainment cost him per year?

days years

$$1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9 = 362880 = 994.19177$$

$$L. 21 \div 994.19177 \text{ equal to } L. 0 \text{ } 5 \frac{1}{4} \text{ his board per year}$$

SQUARE ROOT. ✓

Any number multiplied by itself produces a square, as $2 \times 2 = 4$, or $4 \times 4 = 16$, or $16 \times 16 = 256$. This is called Evolution, or the raising of the second power.

Evolution, or the extracting of the second power, is to find the square root of any given number.

RULE.

Place a point over the units figure, and over every second figure to the left hand, in whole numbers, and to the right hand in decimals.

The points shew how many places will be in the root.

Place the root of the left hand point in the quotient, and subtract its square from it.

To the right of the remainder bring down the next point, and double the quotient for a divisor.

Find how often the divisor can be found in the dividend, omitting the units place, and write the figure found, both in the quotient, and on the right of the divisor.

Multiply the said figure into this divisor, then subtract, and bring down the next point, then double the root, &c. as before, till all the points be brought down, and when there is occasion, continue the operation by annexing pairs of cyphers.

EXAMPLES.

$$\begin{array}{r} 925444(962 \\ 81 \end{array}$$

$$\begin{array}{r} 1669264(1292 \\ 1 \end{array}$$

$$\begin{array}{r} 186)1154 \\ 1116 \end{array}$$

$$\begin{array}{r} 22)166 \\ 44 \end{array}$$

$$\begin{array}{r} 1922)3844 \\ 3844 \end{array}$$

$$\begin{array}{r} 249)2292 \\ 2241 \end{array}$$

$$\begin{array}{r} 2582)5164 \\ 5164 \end{array}$$

$$\begin{array}{r} 42852312064(207008 \\ 4 \end{array}$$

$$\begin{array}{r} 407)2852 \\ 2849 \end{array}$$

$$\begin{array}{r} 4060875625).63725 \\ 36 \end{array}$$

$$\begin{array}{r} 414008)3312064 \\ 3312064 \end{array}$$

$$\begin{array}{r} 123)460 \\ 369 \end{array}$$

$$\begin{array}{r} 1267)9187 \\ 8869 \end{array}$$

$$\begin{array}{r} 12742)31856 \\ 25484 \end{array}$$

$$\begin{array}{r} 127445)637225 \\ 637225 \end{array}$$

PROBLEM 1.

To find a geometrical mean between two given numbers.

Multiply the given numbers into one another, and extract the square root of the product.

EXAMPLES.

1st, What is the geometrical mean between (a) 50, and (b) 128?

$$a \times b \sqrt{=} 80 \text{ Ans.}$$

2d, Suppose a tube (a) 32 inches wide at the bottom, and (b) 40 at the top, what is the mean width?

$$a \times b \sqrt{=} 35.777 \text{ Ans.}$$

3d, Required the side of a square, equal to a parallelogram 165 feet long, and 36 feet broad?

$$\text{Ans. } 77.07139$$

PROBLEM 2.

To find the side of a square equal in area to any given surface.

Extract the square root of the given area.

EXAMPLE.

1st, Required the side of a square, equal to an irregular figure, the area of which is (a) 460?

$$a \sqrt{=} 21.447 \text{ Ans.}$$

PROBLEM 3.

To find the diameter of a circle equal in area to any regular figure.

Find the area of the given figure, divide this area by .7854, and extract the square root of the quotient.

EXAMPLE.

Required the diameter of a circle equal to a square, the side of which is (a) 36.465?

$$a \times a \div .7854 \sqrt{=} 41.14629 \text{ Ans.}$$

PROBLEM 4.

To increase or diminish a circle in any given proportion.

Square the diameter of the given circle, enlarge or diminish that square in the proportion required, and extract the square root thereof, which will be the diameter of the circle required.

EXAMPLE.

A malt kiln (a) 18 feet in diameter, dries 4 bolls, what must be the diameter of one which will dry three times as much?

$$a \times a \times 3 \sqrt{=} 31.1769 \text{ Ans.}$$

PROBLEM 5.

To find any side of a right angled triangle, having the other two sides given.

CASE 1.

The two legs given to find the hypotenuse.

Square each leg separately, add the products, and extract the square root of the sum.

EXAMPLE.

There is a wall of a fortification (a) 235 feet high, at the bottom of which there is a moat or ditch (b) 125 feet broad; required the length of a scaling ladder that will reach from the farthest side of the moat to the embattlements?

$$a \times a = p$$

$$b \times b = p$$

$$s \sqrt{=} 235.3322 \text{ feet, Ans.}$$

CASE 2.

The hypotenuse and one leg given to find the other leg.

Subtract the square of the given leg from the square of the hypotenuse, and extract the square root of the remainder.

EXAMPLE.

A ladder (a) 40 feet long may be so placed upon one side of the street that it will reach a window (b) 33 feet from the ground, and without moving it at the bottom it will reach another window on the other side (c) 21 feet high, what is the breadth of the street?

$$a \times a = p - b \times b = 22.6$$

$$a \times a = p - c \times c = r \sqrt{=} 34.04 + 22.6 = 56.64 \text{ feet, Ans.}$$

PROBLEM 6.

To find the area of a triangle, having it's three sides given.

Add the given sides, from half their sum subtract each side separately, multiply these remainders into the half sum continually, and extract the square root of the product.

EXAMPLE.

Required the area of the triangle at A, B, C, the side A, B, being (a) 250, B, C, (b) 320, and C, A, (c) 420?

$$a + b + c \div 2 = 495 - c = 75$$

$$-a = 245$$

$$-b = 175$$

$$495 \times 245 \times 175 \times 75 = p \sqrt{=} 39896.5 \text{ Ans.}$$

PROBLEM 7.

To find the limits of the visible horizon.

Add the semi-diameter of the earth, being 21039008 feet, to the height of the observer's eye, square the sum, from it subtract the square of the earth's semi-diameter, and extract the square root of the remainder.

EXAMPLE.

If the spire of a church be (a) 224 feet high, how far would a mad fellow see were he to get up and ride upon the

vane, supposing his eye to be (b) 3 feet above the vane, and nothing to intercept his view of the horizon?

$$a + b + 21039008 \times 21039235 = p - s = 18.5121039008 \times 21039008$$

2d, In the midst of a meadow well stored with grass,

I took just an acre to tether my-als;

How long must the cord be, that feeding all round,

He may not graze less or more than his acre of ground?

660 feet, length of an acre

66 feet the breadth of an acre

$$\begin{array}{r} 3960 \\ 3960 \end{array}$$

43560 square feet in an acre *feet in*

$$\text{As } 1 : 1.2732 :: 43560 : 235.5 \div 2 = 117.9 \text{ Ans.}$$

3d, There is a may-pole whose top end was broken off by a blast of wind, and the top end in falling, struck the ground at (a) 15 feet distance from the top of the may-pole; the broken piece was (b) 39 feet, I demand the length of the may-pole?

$$b \times b = p - p = r \sqrt{= 36}$$

$$a \times a = p$$

Piece standing is 36 feet

Piece broken is 39

75 Ans.

4th, There is a round floor whose content is 45.938271-604 square feet, required the side of a square floor equal to it in area?

Ans. 6.7 feet

5th, A round malt kiln, whose diameter is 12 feet, is to be enlarged, so as to hold three times as much malt as formerly; required the new diameter?

Ans. 20.078 feet

6th, A tower is surrounded by a ditch 40 feet wide, and a scaling ladder 50 feet long, will reach from the outside of the ditch to the top of the tower; required the height of the tower?

Ans. 30 feet.

CUBE ROOT.

Any number multiplied twice into it's self produces a cube, as $3 \times 3 \times 3 = 27$.

TO EXTRACT THE CUBE ROOT.

RULE. Find the cube root of the first period in the nearest integer, and place it as the first part of the root sought. — Subtract it's cube from the first period, and bring down the next to the remainder for a resolvend. — Multiply the square of the root by 3, to the product annex two cyphers. — Divide the resolvend by it, for the next figure of the root; multiply thrice the first part of the root into this quotient, and to the product affix a cypher; also, square the quotient, add these products to the divisor, multiply the sum by the

quotient, and subtract the product from the resolvend; bring down the next period for a new resolvend, then find a new divisor, and proceed as before.

Note, The units figure, and every third figure to it's right and left must be pointed.

EXAMPLES.

1st, Required the cube root of 41781923?

$$\begin{array}{r} 41781923(347 \text{ Ans.} \\ 27 \end{array}$$

$$\begin{array}{r} 14781 \\ 12304 \end{array}$$

1st product $3 \times 3 \times 3 = 2700$

2d product $3 \times 3 \times 4 = 360$

3d product $4 \times 4 = 16$

$$\begin{array}{r} 2477923 \\ 2477923 \end{array}$$

True divisor, 3076

$$34 \times 34 \times 3 = 346800$$

$$34 \times 3 \times 7 = 7140$$

$$7 \times 7 = 49$$

True divisor 353989

2d, Required the cube root of $\frac{1}{4}$?

$$\begin{array}{r} .142857(.522 \text{ Ans.} \\ 125 \end{array}$$

$$5 \times 5 \times 3 = 7500$$

$$5 \times 3 \times 2 = 300$$

$$2 \times 2 = 4$$

$$\begin{array}{r} 17857 \end{array}$$

$$7804 \times 2 = 15608$$

$$2249142$$

$$52 \times 52 \times 3 = 811200$$

$$52 \times 3 \times 2 = 3120$$

$$2 \times 2 = 4$$

$$814324 \times 2 = 1628648$$

$$620494$$

3d, Required the cube root of 5?

$$\begin{array}{r} 5.000(1.709 \text{ Ans.} \\ 1 \end{array}$$

$$559)4000$$

$$3913$$

$$8715981) . 87000000$$

$$78443829$$

$$8556171$$

4th, Required the cube root of 7612181.7612?

Ans. 196.71, &c.

5th, What is the cube root of 7612.81216?

Ans. 19.67, &c.

6th, What is the cube root of .13?

Ans. .002197

7th, What is the cube root of .12000.81261?

Ans. 22.69

8th, What is the cube of .007?

Ans. .000000343

9th, There are two numbers, whereof the greater is 2579890752, their difference is 1152, what is the lesser, and what the cube root of their sum?

Ans. The lesser is 2579889600, and the cube root of their sum is 1728.

10th, There are three boxes, the content of one is (a) 5000 solid inches, of another (b) 8328, and of the third (c) 10000. Required the side of a cubical box that shall contain as much as all the three?

$$a + b + c \sqrt[3]{} = 28.57 \text{ inches, } \textit{Ans.}$$

11th, Suppose a bullet (a) 4 inches diameter, weigh (b) 50 lbs. what will a bullet weigh, whose diameter is (c) 6 inches?

$$a \times a \times a = 1 \text{ ft p}$$

$$c \times c \times c = 2 \text{ d p}$$

lbs

If 1 ft p : 2 d p :: b : 168.75 *Ans.*

12th, There is a ball or globe of marble, whose diameter is (a) 6 inches, and it's weight (b) 11 lbs. what will be the diameter of another globe of the same marble, that weighs (c) 50 lbs.?

$$a \times a \times a = p \quad \text{If } b : p :: c : 981.81 \text{ lbs. } \textit{Ans.}$$

13th, The diameter of an iron shot is 4.8 inches, what is it's weight?

Ans. 15.552 lbs.

Note, Take $\frac{1}{8}$ of the cube of the diameter, then $\frac{1}{8}$ of that eighth, and the sum will be the weight required in lbs.

14th, What is the weight of a leaden ball, whose diameter is 1.5 inches?

Ans. 12 ounces

Note, Take $\frac{1}{8}$ of the cube of the diameter and from it subtract $\frac{1}{8}$ of this third, and the remainder is the weight required nearly.

15th, How many pounds of powder will a hollow shell hold, whose internal diameter is 6 inches?

Ans. 3.64128 lbs.

Note, Cube the internal diameter in inches, and divide by 59.32, and the quotient is the weight nearly.

16th, The diameter of the caliber of a gun is 8 inches, what length of it will be filled by 6 pounds of powder?

Ans. 3.8125 inches.

Note, 1st, Divide the weight in pounds by the square of the diameter in inches. 2d, Multiply the quotient by 40, and from the product subtract $\frac{1}{8}$ of the quotient. 3d, From the remainder take $\frac{1}{8}$ of that third, and the last remainder will be the answer nearly.

COMPOUND INTEREST.

Compound Interest is that which arises from the principal

and interest taken together, as it becomes due at the end of each stated time of payment.

RULE.

1st, Find the amount of L.1 for 1 year at the given rate per cent.?

2d, Involve the amount thus found, to such a power as is denoted by the number of years.

3d, Multiply this power by the principal, or given sum, and the product will be the amount required.

4th, Subtract the principal from the amount, and the remainder will be the interest.

EXAMPLES.

1st, What is the interest and amount of L.600 for 3 years, at 5 per cent.?

1.05 amount of L.1 for a year

1.05

1.1025

1.05

1.157625

600

694.575000 amount

600.

94.575 interest

2d, What is the amount of L.400 for 4 years, at 4 per cent?

Ans. L.467 18 10 $\frac{1}{4}$

3d, What is the amount of L.750 for 6 years, at 4 per cent. per annum?

Ans. L.948.98926

4th, What is the interest and amount of L.500 for 4 years at 3 $\frac{1}{4}$ per cent?

Ans. L.573.7615 amount, L.73 7615 interest

5th, What is the amount of L.900 for 8 years at 4 $\frac{1}{2}$ per cent?

Ans. L.1279.8905

6th, What is the amount of L.600 for 16 years, at 6 per cent?

Ans. L.1524.15102

ANNUITIES.

An annuity is a sum of money, payable at stated times, for a certain number of years, or for ever, sometimes yearly, sometimes quarterly, &c.

Arrears signifies an annuity kept by the debtor in his own hands beyond the stated time of payment.

Amount signifies the sum of all the annuities for the time they have lain in the debtor's hands, together with the interest due upon each.

Present worth is the price which ought to be given for an annuity which is to be bought off, or paid all at once, at the beginning of the first year.

CASE 1.

To find the amount of an annuity at simple interest.

RULE.

1st, Find the sum of all the natural series of numbers, 1, 2, 3, &c. to the number of years, wanting 1.—2d, Find the interest of the annuity for one year, then multiply it by the sum last found, and the product will be the whole interest due upon the annuity.—3d, Add the product of the annuity and time to this product, and the sum will be the amount sought.

EXAMPLES.

1st, What is the amount of an annuity of L.200 for 12 years, at 4 per cent?

$$1+2+3+4+5+6+7+8+9+10+11=66$$

L.8=1 year's interest for L.200

66

528

$$200 \times 12 = 2400$$

L 2928=amount required

2d, If a pension of L.180 per annum be forborn 9 years, what will it amount to, allowing interest at 5 per cent?

$$1+2+3+4+5+6+7+8=36$$

L.9=1 year's interest

36

324

1620

1944 *Anf.*

3d, What will an annuity of L.200 amount to in 5 years, to be paid by half yearly payments, at 6 per cent. per annum, simple interest?

$$1+2+3+4+5+6+7+8+9=45 \times 3 + 1000 =$$

L.1135 *Anf.*

Note, Halve the annuity and rate per cent. Find the sum of all the time in half years, wanting 1, and proceed as before; if quarterly, work in a quadruple proportion, &c. from which it is evident, that the oftener the payments are made, the greater the value of the annuity to the annuitant.

CASE 2.

To find the present worth of an annuity at simple interest.

RULE.

Find the present worth of each year by itself, as it becomes due, according to the rules given in Discount, then add all the quotients for the answer.

EXAMPLES.

1st, What is the present worth of an annuity of L.150, to continue 4 years, at 4 per cent. per annum, simple interest?

$$\text{If } 104 : 100 :: 150 : 144.230769$$

$$108 : 100 :: 150 : 138.888888$$

$$112 : 100 :: 150 : 133.928571$$

$$116 : 100 :: 150 : 129.310344$$

L.546.358572 *Anf.*

2d, What is the present worth of an annuity or pension of L.400 to continue 5 years at 6 per cent?

$$\text{If } 106 : 100 :: 400 : 377.3584$$

$$112 : 100 :: 400 : 357.1428$$

$$118 : 100 :: 400 : 338.9828$$

$$124 : 100 :: 400 : 322.5804$$

$$130 : 100 :: 400 : 307.6920$$

L.1703.7564 *Anf.*

CASE 3.

To find the amount of an annuity at compound interest.

RULE.

1st, Make one the first term of a geometrical series, and let the ratio be the amount of L.1 for one year at the given rate per cent.—2d, Make as many terms in the series as there are years given in the question, the sum of which multiplied by the given annuity is the answer.

EXAMPLES.

1st, What is the amount of an annuity of L.60 to continue 4 years, reckoning interest at 4 per cent?

$$1 \quad 2 \quad 3$$

$$1+104+104+104=4.246464 \times 60 = \text{L.254 } 15 \text{ } 9 \text{ } \textit{Ans.}$$

2d, If L.80 yearly rent or annuity be forborn 5 years, what will it amount to at 5 per cent. per annum, compound interest?

$$1 \quad 2 \quad 3 \quad 4$$

$$1+1.05+1.05+1.05+1.05=5.52563125 \times 80 =$$

L.442.0505 *Anf.*

CASE 4.

To find the present worth of annuities at compound interest.

RULE.

Find the ratio, or the amount of L.1 for a year, as before, and divide the annuity by it, and it will quote the present value of 1 year's annuity.—2d, Square the ratio, and divide the annuity by it, and it will quote the present value of the annuity for 2 years.—3d, Find the present value of each by itself, in the same way, and the sum of the products will be the answer.

EXAMPLES.

1st, What is the present worth of an annuity of L.120, to continue 4 years at 5 per cent?

Ratio=1.05)120(114.28571 present worth for 1 year
²
 1.05 twice multiplied=1.1025)120(108.84353 2 years
³
 1.05 three times multiplied=1.157625)120(103.66051
 present worth for 3 years
⁴
 1.05 four times multiplied=1.215506)120(98.72431
 present worth for 4 years

L.425.51406 *Ans.*

2d, What is the present worth of an annuity of L.140, to continue 3 years at 5 per cent?

L.133.333 present worth for 1 year
 126.984 do. for 2 years
 120.947 do. for 3 years

L.381.264 *Ans.*

CASE 5.

To find the present value of a freehold estate, or an annuity to continue for ever, at compound interest.

RULE.

As the rate per cent. is to 100, so is the annual rent to the present worth.

EXAMPLES.

1st, An estate brings in yearly (a) L.364 15, what would it sell for, allowing the purchaser (b) 5 per (c) cent. compound interest for his money?

If b : c :: a : L7295, *Ans.*

2d, What is the price of a perpetual annuity of L60, discounted at $4\frac{1}{2}$ per cent? *Ans.* L1333 6 8

3d, What is a freehold estate of L.45 a-year worth, allowing the buyer 6 per cent. compound interest?

Ans. L.750

CASE 6.

To find the present worth of an annuity or freehold estate in reversion, at compound interest.

RULE

Find the present value of the annuity, supposing it to be entered on immediately. Find the present value of the last present value, discounting for the time between the purchase and when the annuity was entered upon, which will be the answer.

EXAMPLES.

1st, The reversion of a freehold estate of L.180 per annum, to commence 6 years hence, is to be sold, what is it worth in ready money, allowing the purchaser $4\frac{1}{2}$ per cent. for his money?

6

If $4.5 : 100 :: 180 : 4000$ and $1.045 = 1.30226)4000($
 L.3071.582 = present worth of L.4000 for 6 years,
 or the whole present worth required

2d, The reversion of a freehold estate of L.100 per annum, to commence 15 years hence, is to be sold, what is the worth in ready money, allowing the purchaser 5 per cent. for his money? *Ans.* L.962.034

QUESTIONS FOR EXERCISE.

EXPRESS IN FIGURES.

1st, Nine hundred and twenty million, nine thousand, four hundred and two.

2d, Twelve million, twelve thousand, twelve hundred and twelve.

3d, What number is that which being multiplied by 19, the product will be 551? *Ans.* 29

4th, A privateer takes a prize to the value of L.2851 4, of which the captain gets $\frac{1}{8}$, each of six officers $\frac{1}{12}$ of the remainder, and the private men, being 45 in number, get the rest equally divided among them, what is each man's share?

Ans. { Captain's share, - L.178 4 0
 Each officer's - 83 10 7 $\frac{1}{2}$
 Each private man's - 48 5 3

5th, A gentleman setting out on a journey, carried along with him 8 joanneſes, being L.3 12 each, 17 guineas, 13 half guineas, 14 crowns, 10 half crowns, 15 shillings, and 9 sixpences, and finds on his return, by his pocket book, that he had spent L.49 4. How many pounds sterling did he carry out, and how many brought he home?

Ans. He carried out L.59 4, and brought home L.10.

6th, How many trees may be planted on an English acre at 5 feet distance? *Ans.* 1742 $\frac{1}{2}$

7th, A gentleman, whose estate is L.800 per annum, pays L.50 for house rent, and his daily expence besides, is two guineas and a half, how much does he save, or overspend in a year? *Ans.* L.208 2 6

8th, How many dollars at 4s. 3d. each, must be given for 450 French crowns, at 4s. 6d. each? *Ans.* 476 $\frac{8}{17}$

9th, What does the whole pay of a man of war's crew, of 535 sailors, amount to for $3\frac{1}{2}$ years' service, at 28s. 4d. per month? *Ans.* L.31832 10

10th, A snail, in getting up a may-pole, 65 feet high, was observed to climb 10 feet every day, but every night he came down 5 feet. In what time, by this method, did he reach the top of the pole? *Ans.* 13 days

11th, A butcher buys an ox for L.12 4, and after feeding him with 20 pecks oats at 18s. 6d. per quarter, and 15 trusses hay at 1s. 6d. slaughters him, and sells the beef, being 38 stones, at 7d. per pound; $6\frac{1}{2}$ stones tallow at 7 $\frac{1}{2}$ d. per lib. allowing 14 lbs. per stone; and the hide for L.1 4 6. Required the gain or loss?

Ans. L.5 13 7 $\frac{1}{2}$ gain

12th, If 4 cwt. hops, bought at L.4 10 per cwt. be mixed with 3 cwt. at L.5 6 8, and 1 cwt. 24 lbs. at 10 $\frac{1}{2}$ d.

per lib. ; at what rate must they be sold per lib. in order that the gain may be L.6 10?

Ans. 1s. 0d. $\frac{27}{100}$ per lib.

13th, If a cow yields 15 quarts milk in a day for 220 days, and 22 quarts make 1 lib. butter, how many libs. butter will be obtained in the season, and what does the value come to at 13d. per lib.?

Ans. 150 libs. value L.8 2 6

14th, A stone that measures 6 feet, 3 inches long, 4 feet; 1 inch broad, and 2 feet, 7 inches deep, how many solid feet doth it contain?

Ans. $\frac{\text{feet in } p}{65 \quad 11 \quad 1 \quad 9}$

15th, If I have an estate of L.400 per annum, what may I spend daily, and yet lay up L.180 per annum?

Ans. L.0 12 $0\frac{1}{2}\frac{11}{100}$

16th, If a tradesman earns 3s. 4d. per day, how much is that for 14 weeks, Sundays excepted?

Ans. L.14

17th, A gentleman's daily expences is L.1 5 6, and he saves L.400 in the year, what is his yearly income?

Ans. L.865 7 6

18th, Bought 130 pieces of cloth, for which I delivered 3675 ells of Holland, at 7s. 6d. per ell English, what cost a piece of that cloth?

Ans. L.10 12 $0\frac{1}{2}\frac{1}{100}$

19th, I have laid out for a merchant L.700 10, he allows me $2\frac{1}{2}$ per cent. commission; before that, I owed him L.175 4 8, how much is he indebted to me?

Ans. L.542 15 7

20th, Bought a tun of wine for L.80, at what price must I sell it per quart, to gain L.6 10 by the whole, when there were 28 gallons leaked out?

Ans. 1s. 11d. $\frac{19}{100}$

21st, A butcher goes to market with L.301 4, and buys oxen at L.11 8 each, cows at L.9 10, calves at L.2 18, and sheep at 16s. he bought the same number of each kind. How many of each sort had he for his money?

Ans. 12

22d, Sold quills at 11s. per thousand, by which I cleared $\frac{1}{3}$ of the money, but growing scarce, I raised them to 12s. 3d. a thousand, what did I clear per cent. by the latter price?

Ans. L.48 $\frac{1}{11}$ per cent.

23d, I have laid out for a merchant L.700 10, he allows me $2\frac{1}{2}$ per cent. before that I owed him L.100 10 6, how much is he indebted to me?

Ans. 617 9 9

24th, I carried to market 50 guineas, 15 half guineas, 12 quarter guineas, 19 half crowns, 32 joannefes, and L.1 10 6; I sold there 2 cows for L.6 10 each; I bought 376 yards linen at 3s. per yard, 12 cwt. cheese at 8d. per lib. also 18 quarters wheat at 38s. per quarter, my expences were L.2 12. Required how much I brought home?

Ans. 6d.

25th, How much coffee at 2s. 3d. per lib. must be given in barter for 376 gallons rum, at 7s. per gallon?

Ans. 10 cwt. 1 qr. 21 lib. 12 oz.

26th, A delivered to B 346 yards of cloth, at 12s. 10 $\frac{1}{2}$ d. per yard, for which he received L.60 in money, and the balance in leather at 7 $\frac{1}{2}$ d. per lib. how many pounds of leather should B give to A?

Ans. 5207 $\frac{1}{2}$ lbs.

27th, C has broad cloth worth 14s. 6d. which he rates at 15s. 11d. what should D charge for wool worth 10s. per stone, to be equivalent to C's bartering price; and how much wool must he give for 14 pieces of cloth, each 14 yards?

Ans. D should charge 10s. 11 $\frac{1}{2}$ d. to be equal with C's bartering price, and D must give 284 $\frac{1}{2}$ stones of his wool for C's cloth.

28th, Bought goods to the amount of L.600 but coming to a bad market, I was obliged to sell 25 per cent. below prime cost, what did I receive for them?

Ans. L.450

29th, Sold cloth at 11s. 8d. by which I gained 10 $\frac{1}{2}$ per cent. what was the prime cost?

Ans. 10s. 6 $\frac{1}{2}$ d.

30th, Sold goods for L.80 and by so doing lost 15 per cent, whereas, I ought in dealing to have cleared 20 per cent. Then how much under their just value were they sold?

Ans. L.32 18 9 $\frac{1}{2}$

31st, If by remitting to Holland at 35s. 6d. per pound sterling, 5 per cent. be gained, how goes the exchange, when, by remittance, I clear 8 per cent?

Ans. 36s. 6d. $\frac{6}{11}$

32d, A, B and C have L.300 to be divided among them in such a manner, that 2 times A's share be equal to 3 times B's, and 4 times B's be equal to 5 times C's, what are their shares?

Ans. A's share { L.136 7 3 $\frac{1}{11}$
B's { 90 18 2 $\frac{1}{11}$
C's { 72 14 6 $\frac{1}{11}$

33d, A father orders his estate of L.1000 to be divided among his three sons, so as the eldest gets $\frac{1}{2}$, the second $\frac{2}{3}$, and the third $\frac{1}{6}$: Quere, each son's share?

Ans. The eldest son's share is L.339 16 1 $\frac{1}{2}$ $\frac{6}{11}$
The second son's 271 16 10 $\frac{1}{2}$ $\frac{10}{11}$
And the third son's 388 6 11 $\frac{1}{2}$ $\frac{1}{11}$

34th, There are gained by trading with a ship L.800 10, now suppose that $\frac{1}{4}$ of her belongs to A, $\frac{1}{4}$ to B, and the rest to C, what must each have of the gain?

Ans. A, L.200 2 6
B, 333 10 10
C, 266 16 8

35th, How long time will it take for L.695 to produce an equal sum of interest at 5 per cent. simple interest?

Ans. 20 years.

36th, Put out L.500 to interest, and at the end of 3 years there was found to be L.560, what was the rate of interest?

Ans. 4 per cent.

37th, What difference is there between the interest of L.450 at 5 per cent. for 5 years, and the discount of the same sum at the same rate and time?

Ans. L.22 10

38th, If 24 men can perform a piece of work in 10 days,

how many men will accomplish another, that is thrice as much in $\frac{1}{2}$ of the time?

Ans. 360 men.

39th, Suppose that I have $\frac{4}{5}$ of a ship, worth L.3200, what part of her have I left, after selling $\frac{1}{5}$ of $\frac{4}{5}$ of my share, and what is it worth?

Ans. $\frac{3}{5}$ worth L.2742 17 11 $\frac{5}{8}$

40th, What length must be cut off a board 9 $\frac{1}{2}$ inches broad, to contain a square foot, or as much as 12 inches in length, and 12 in breadth?

Ans. 15 $\frac{1}{8}$ inches.

41st, Four men bought a hive of bees for 20s. of which A must pay $\frac{1}{4}$, B $\frac{1}{4}$, C $\frac{1}{4}$, and D $\frac{1}{4}$, what is the share of each partner?

Ans. A's 7s. $\frac{1}{4}$, B's 5s. $\frac{1}{4}$, C's 4s. $\frac{1}{4}$, D's 3s. $\frac{1}{4}$

42d, If a tower be 384 feet high from the foundation, and a sixth part be under ground, and an eighth part under water, how much in height is visible?

Ans. 272

43d, If one pound ten, and forty groats,

Will buy a load of hay;

How many pounds, with nineteen crowns,

For twenty loads will pay?

Ans. L.38 11 8

44th, An annuity of L.51 15, to continue 21 years, is to be sold for ready money, what is it worth at 5 per cent. simple interest?

Ans. L.795 3 8

45th, If L.50 in 5 months gain L.2 $\frac{1}{4}$, what time will L.13 $\frac{1}{2}$ require to gain L.1 $\frac{1}{4}$?

Ans. 9 months

46th, What number multiplied by $\frac{1}{2}$, produceth 11 $\frac{2}{3}$?

Ans. 26 $\frac{4}{3}$

47th, A gentleman bought a house with a garden, and a good horse in the stable, for L.500. Now he paid 4 times the price of the horse for the garden, and 5 times the price of the garden for the house. What was the price of each?

Ans. He paid L.20 for the horse

80 for the garden

400 for the house

L.500 proof

48th, A vessel that holdeth 60 gallons, hath 4 cocks, and being filled with water, or any other liquor, if they all be set open at once the liquor will run out in 24 hours. Now the second cock will empty twice as much as the first during the same time, and the third will empty it three times as much as the first in the same time, and the fourth will empty 5 times as much as the first. What number of gallons doth each cock empty?

Ans. $\left\{ \begin{array}{l} \text{The first cock empties } 5 \frac{1}{4} \text{ gallons} \\ \text{The second cock empties } 10 \frac{1}{2} \text{ gallons} \\ \text{The third cock empties } 16 \frac{1}{4} \text{ gallons} \\ \text{The fourth cock empties } 27 \frac{1}{4} \text{ gallons} \end{array} \right.$

49th, A grocer delivered 17 cwt. 3 qrs. 10 lib. of tobacco in the roll to be cut and dried, and when it came home,

it held out 16 cwt. 10 qrs. 14 lib. I demand how much was lost in every pound, and also, supposing it cost in the roll 8d. $\frac{5}{8}$ per pound, and the cutting 1d. $\frac{1}{4}$ per pound, I demand what it now stands him in?

Ans. $\left\{ \begin{array}{l} \text{Lost per lib. 1 oz. 8 drams } 1 \frac{1}{2} \frac{1}{8} \\ \text{It stands him in L.87 5 } 3 \frac{1}{8} \end{array} \right.$

50th, Suppose sugar at L.3 5 per cwt. and at L.3 15 per cwt. were mixed together so as 20 cwt. of the mixture were worth L.70, how much of each sort was adopted in the mixture?

Ans. 10 cwt. at L.3 15
and 10 cwt. at L.3 5

51st, The valued rent of a whole parish is L.8000, and the assessment for poor's rates L.175, with how much ought a valuation of L.839 10 to be assessed?

Ans. L.18 7 2 $\frac{1}{2}$

52d, A can do a piece of work in 25 days, B can do it in 30 days, in what time will they do it working together?

Ans. 13 $\frac{7}{11}$ days

53d, A privateer sailing at the rate of 12 miles an hour, discovers a ship 20 miles a-head making way at the rate of 10 miles an hour; required how long and how many miles the ship can hold out before she be overtaken by the privateer?

Ans. 10 hours the time, 100 miles sailed by the ship, and 120 miles sailed by the privateer.

54th, Three gardeners, A, B and C, having bought a piece of ground, find the profits of it amount to L.240 per annum. Now the sum of money which they laid down was in such proportion, that as often as A paid L.5, B paid L.7, and as often as B paid L.4, C paid L.6; I demand how much each man must have of the gain?

Ans. $\left\{ \begin{array}{l} A, L.53 6 8 \\ B, 74 13 4 \\ C, 112 0 0 \end{array} \right.$

L.240 0 0

55th, Two men set out at the same time from the same place, but go contrary ways, they travel each of them 35 miles per day; I demand the time in which they will have travelled 1000 miles?

Ans. 14 days, 6 hours, 51 $\frac{1}{2}$ minutes

56th, If 12 inches of length, 12 of breadth, and 12 of thickness, make a solid foot, what length of a plank that is 8 inches broad and 6 inches thick, will make a solid foot?

Ans. 3 feet

57th, A, B, C, and D have L.200 to be divided among them in such a manner, that for every L.3 A received, B must have L.5, C L.7, and D L.10; that is, their shares are to be as the numbers 3, 5, 7, 10. Required their shares?

Ans. $\left\{ \begin{array}{l} A's \text{ share } L.24 \\ B's \text{ share } 40 \\ C's \text{ share } 56 \\ D's \text{ share } 80 \end{array} \right.$

L.200 proof

58th, If L320 be received for a debt payable 4 years hence, and an allowance of 4 per cent. to the debtor for present payment, what was the debt?

Ans. L374 7

59th, A farmer is willing to make a mixture of rye, at 5s. per bushel, barley at 4s. 2d. per bushel, and oats at 3s. 4d. per bushel, how much must he take of each to sell it at 4s. per bushel?

Ans. 8 bushels of barley, 8 of rye, and 14 bushels of oats

60th, A general of an army, after a fore battle, finds on reviewing his men, that $\frac{1}{4}$ of them had been slain $\frac{1}{8}$ taken, and that $\frac{1}{11}$ have deserted, so that now he has only 12950 left him. How many were in his army when complete?

Ans. 20000

61st, Laid out some hundred pounds upon snuff, at L6 per cwt. which being damnified, I am willing to lose 5 per cent. by it, for what must I sell the cwt?

Ans. L5 14

62d, The height of a tree is 72 feet; it happens that being broke by the wind, the top falls 24 feet from the root. How many feet of it stood, and how many fell?

Ans. 32 stood; 40 fell

63d, Three men, A, B, and C, enter into company, A continued his share of the stock for 5 months, and claimed $\frac{1}{8}$ of the profits, B's continued 8 months, C continued his stock of L800 for 10 months, and required $\frac{1}{4}$ of the profits. Que-
re, A and B's stock?

Ans. A's L355 11 $1\frac{1}{2}$, B's L111 2 $2\frac{1}{2}$

64th, Bought an estate at 20 years' purchase, what rate of interest had I for my money?

Ans. 5 per cent.

65th, A gentleman caught a fish whose head was 9 inches long, the tail as long as the head and half the body, the body was just the length of the head and tail; what was the length of the fish?

Ans. 72 inches

66th, When first the marriage-knot was tied

 Betwixt my wife and me,
My age did hers as far exceed,
 As three times three does three:
But after ten and half ten years
 We man and wife had been,
Her age came up as near to mine
 As eight is to sixteen.
Now Tyro, skill'd in numbers, say,
 What were our ages on the wedding-day?

Answer,

 Sir, forty-five years you had been,
 Your bride no more than just fifteen.

67th, Consigned to my factor in Rotterdam, 16 hhds. of tobacco, 10 cwt. 3 qrs. 25 lib. each, which, per advice is sold at 28 $\frac{1}{2}$ ft. per lib; how much sterling may I draw for allowing 9 per cent. for commission and charges, exchange, 35s. 6d?

Ans. L2394 5 11

68th, Consigned to my factor at Hamburg, 48 hogs-

heads sugar, each 13 cwt. 1 qr. 14 lib. which, per account of sales, sold 7 $\frac{1}{2}$ schil. per lib. how much sterling will my factor remit me, retaining 9 $\frac{1}{2}$ per cent. for commission, charges and bad debts, agio 25 per cent. exchange, 33s. 8 $\frac{1}{2}$ d?

Ans. L.1930 9 6

69th, What will the digging of the foundation of a house, 57 feet long, 26 broad, and 4 $\frac{1}{2}$ feet deep, come to at 16d. per solid yard?

Ans. L16 9 4

70th, What will the glazing of 12 windows come to at 10 $\frac{1}{2}$ d. per foot; four 7 $\frac{1}{2}$ feet high, four 6 $\frac{1}{2}$ feet, and the remaining four 5 $\frac{1}{2}$ feet high, and their breadth 4 feet, 3 inches?

Ans. L14 10 0 $\frac{1}{2}$

71st, A cutter, running at the rate of 8 knots an hour, discovers a smuggler 20 miles off, making way at the rate of 6 knots, or 12 miles an hour; required the number of miles the smuggler can run before she be overtaken by the cutter?

Ans. 60 miles.

72d, A young man received L450, which was $\frac{1}{4}$ of his eldest brother's portion; now three times the eldest brother's portion, was half the father's estate, what was the father's estate?

Ans. L4320

73d, A reckoning of L10 currency in America, was paid with L8 sterling, what was the exchange at that rate?

Ans. 25 per cent.

74th, J. R. has a property of L217 10 aboard the Venus, bound for Jamaica, how much must be insure to cover that property at 10 guineas per cent. 2 $\frac{1}{2}$ per cent. discount in case of a loss?

Ans. L250

75th, A maltster has a kiln which he finds too little for his business, it's diameter being only 18 feet; the diameter of another is required which will hold double the quantity of the old one?

Ans. 25.4558 feet

76th, A maltster has a kiln which he finds too large for his business, it's diameter being 25.4558 feet; the diameter of another which will hold half the quantity is required?

Ans. 18 feet nearly

77th, A travels north 60 miles, and B travels east 80 miles; how many miles are they distant?

Ans. 100 miles

78th, Suppose a box or chest, whose length is 32, breadth 9, and depth 6 inches; required the side of a cube whose solid content shall be equal thereto?

Ans. 12 inches

79th, If a ship of 150 tons be 50 feet long at the keel, of what length shall the keel of that ship be whose burthen is 300 tons?

Ans. 62.988 feet

80th, The length of a piece of timber is 40 feet, 6 inches, the breadth at the greater end is 2 $\frac{1}{2}$ feet, and the thickness 2 feet, 1 inch, and at the lesser end, the breadth is 2

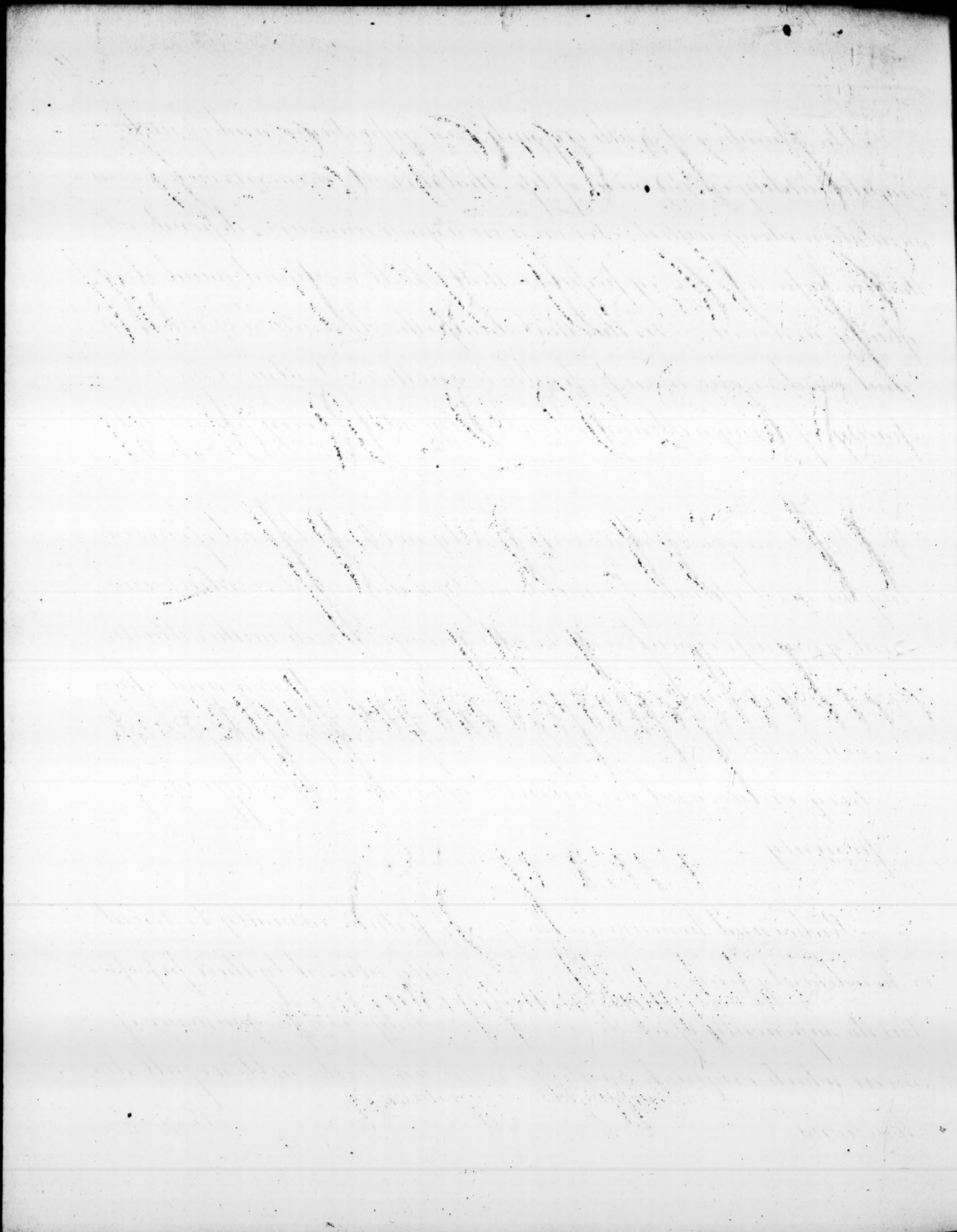
A B C D E F
G H I K L M
N O P Q R S T
U V W X Y Z

a b c d e f g h i j k l m n o p q r s t u

v w x y z & c

a b c d e f g h i j k l m n o p q r s t u v w x y z

a b c d e f g h i j k l m n o p q r s t u v w x y z



11
The education of youth is of such vast importance, and of such singular utility in the scene of life, that it visibly carries its own recommendation along with it: For on it, in a great measure, depends all that we hope to be: every perfection that a well regulated mind would gladly arrive at: 'Tis this that stamps the distinction of mankind and renders one man preferable to another: 'Tis almost the very capacity of doing well; and remarkably adorns every point of life. *Watt.*

The desire of extending our fame by noble deeds, and of increasing the good opinion of mankind by a dignified conduct and real greatness of soul, confers advantages which neither illustrious birth, elevated rank, nor great fortune, can bestow; and which even on the throne, are only to be acquired by a life of exemplary virtue, and an anxious attention to the suffrage of posterity - *Zimmerman.*

Riches and honours are the gifts of fortune casually bestowed or hereditarily received, and are frequently abused by their possessors: but the superiority of wisdom and knowledge is a preeminence of merit which originates with the man and is the noblest of all distinctions. *Bonycastle.*

11
Respect and obedience should both naturally spring from love; to both of which parents have the highest claim, and in general behave to their children with so much care as both to deserve and obtain their love.

Gilpin

The duty which young people owe to their instructors can not be shown better than in the effect which the instructions which they receive have upon them. They would do well therefore to consider the advantages of an early attention to these very important concerns. — Knowledge and Religion.

Gilpin

What species of instruction can be more successful than soft lessons from a female tongue, dictated by a mind profound in understanding, and elevated in sentiment, where the heart feels all the affection that her precepts inspired — Oh, may every mother so endowed be blessed with a child who delights to listen in private to her edifying observations.

Zimmerman

The business of teaching is allowed to be laborious, important and respectable, but the perverseness of children, and impolicy of parents, too frequently render it unsuccessful and disagreeable.

Monitor

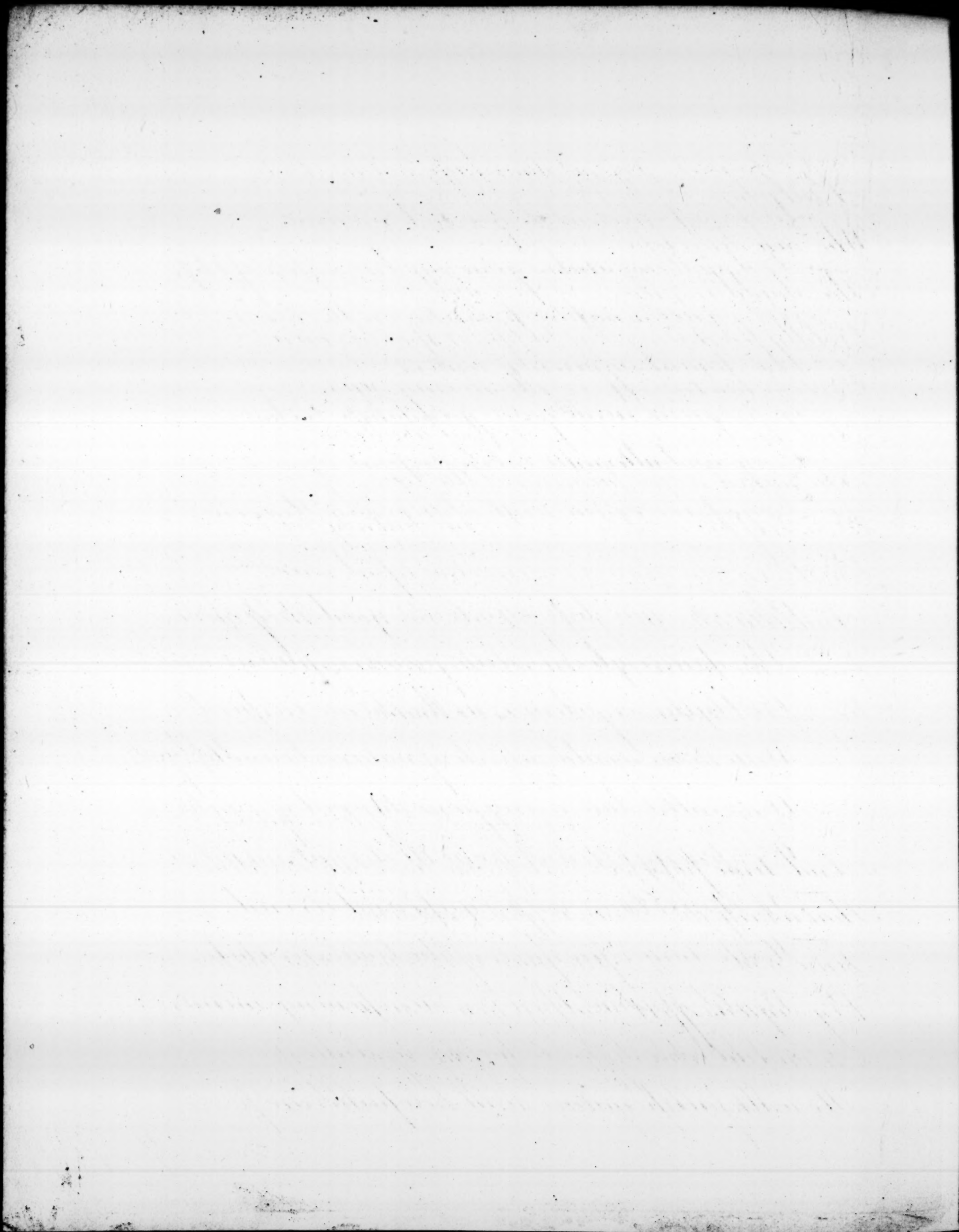
The first of these is the fact that the
 government has been unable to secure
 the necessary funds to carry out its
 policy of non-interference. This is
 due to the fact that the government
 has been unable to secure the necessary
 funds to carry out its policy of non-
 interference. This is due to the fact
 that the government has been unable
 to secure the necessary funds to carry
 out its policy of non-interference.

But where to find that happiest spot below,
Who can direct when all pretend to know?
The shudd'ring tenant of the frigid zone
Boldly proclaims that happiest spot his own,
Exalts his treasures of the stormy seas,
And his long nights of revelry and ease;
The naked negro panting at the line,
Boasts of his golden sands and palmy wine,
Basks in the glare or stems the tepid wave,
And thanks his gods for all the good they gave.
Such is the patriot's boast wherever we roam,
His first best country, ever is at home.

Goldsmith.

— If time past
And time possess'd both pain us, what can please?? —
That which the Deity to please ordain'd —
Time us'd. — The man who consecrates his hours
By vigorous effort, and an honest aim, —
At once he draws the sting of life and death; —
He walks with nature, and her paths are peace.

Young.

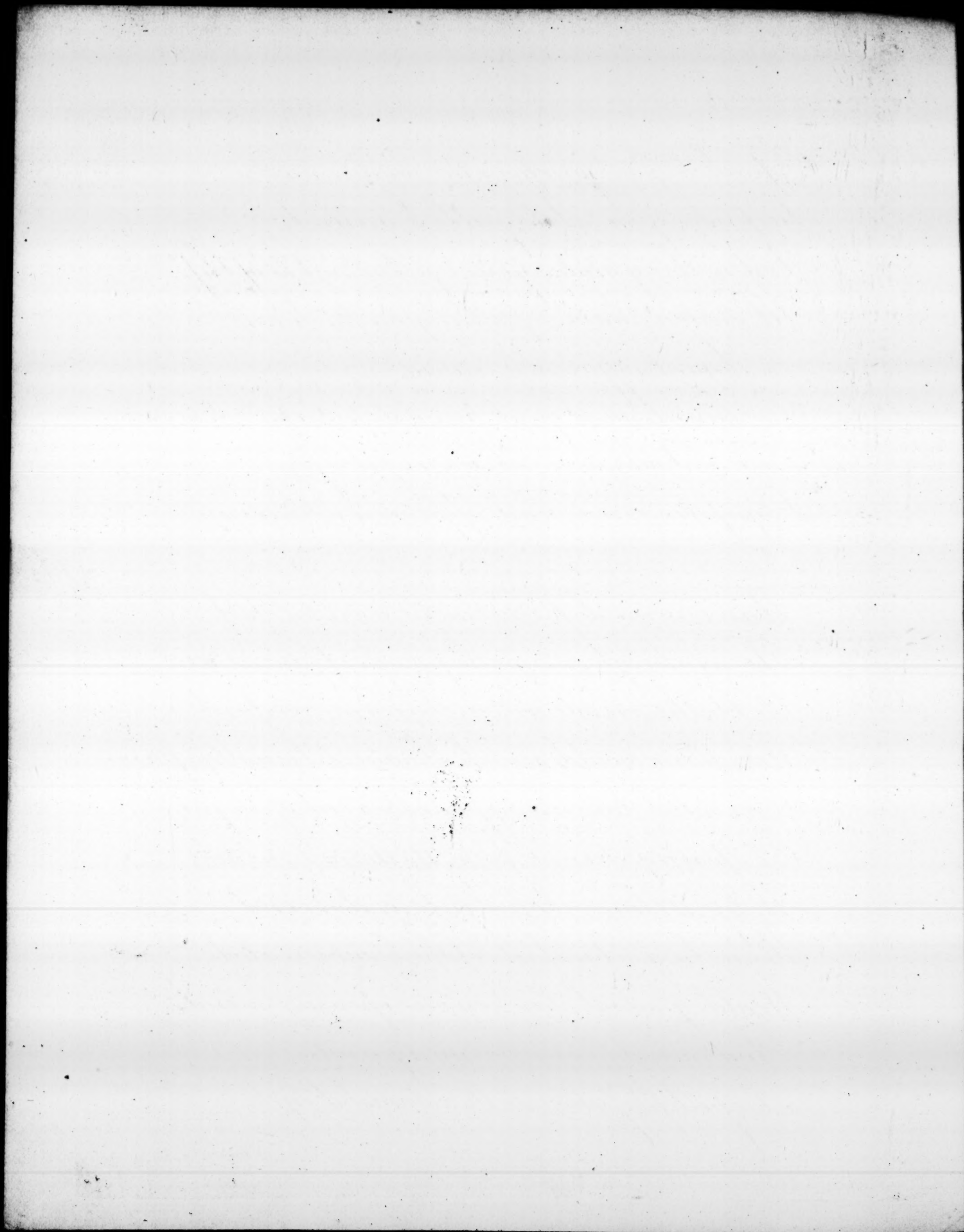


117
O speak the joy! ye whom the sudden tear
Surprises often, while you look around,
And nothing strikes your eye but sights of bliss,
All various nature pressing on the heart:
An elegant sufficiency, content,
Retirement, rural quiet, friendship, books,
Ease and alternate labour, useful life,
Progressive virtue, and approving Heavens.

Thomson

Thus in some deep retirement would I pass
The winter glooms, with friends of pliant soul,
Or blithe, or solemn, as the theme inspir'd:
With them would search if nature's boundless frame
Was call'd, late rising from the void of night
Or sprung eternal from the eternal mind,
Its life, its laws, its progress and its end.
Hence larger prospects of the beauteous whole
Would gradual open, on our opening minds,
And each diffusive harmony unite,
In full perfection to the astonished eye.

Thomson



feet, 2 inches, and the thickness 1 foot, 10 inches; what is the solidity?

Ans. 185.0625 feet

81ft, If a tree girt 12 feet, 4 inches, and be 22 feet long, how many tons of timber are contained in that tree?

Ans. 5 tons, 9 feet, 1 inch.

ERRATA.

Preface, for accounts, read *accounts*—Page 7, Cafe 5, quest. 4, for $695 \div 55$, read $695 \div 8$ —P. 8, note * for three times, read *two times*—Page 13, q. 6, *Ans.* 217570560—do. q. 7, for angels, read *half crowns*—do. q. 12, for 20s. read 10s.—Page 16, q. 8, read cargoes—do. q. 13, for costs, read *cost*—do. q. 15, for ells English, read yards—do. q. 16, read each $78\frac{1}{2}$, also, each $80\frac{1}{2}$ —do. q. 19, for L. 1 4 $9\frac{1}{4}$ read 7s. $7\frac{1}{2}$ d.—do. read each containing—do. *Ans.* 28, for c—a read a—c—Page 21, Crit. for Pract. for 1683, read $168\frac{1}{2}$ —do. *Ans.* L 642 8 $10\frac{1}{4}$ —Page 22d, 1st Bill Par. for L. 448 0 $4\frac{1}{2}$, read L. 488 0 $4\frac{1}{2}$ —do. for $10\frac{1}{2}$, read $10\frac{1}{4}$ —4th do. for L. 4 15, read at L. 5 1 $2\frac{1}{4}$ —do. 5th, for at 4s. 3d. read 3s. 10d.—do. 6th, insert 8332 lbs sugar at 13d.—do. last line, for per cwt. read per hhd.—do. 9th, for 360 lib. read $5679\frac{1}{2}$ —Page 25, Cafe 2, q. 3, read $\frac{6804}{17616}$ —Page 29, Crit. for Div. for $\frac{1}{2}$ of $\frac{1}{2}$, read $2\frac{1}{8}$ —Page 38, Crofs M. for $6\frac{1}{2}$, read $6\frac{1}{4}$ —do. for $1\frac{1}{2}$, read $1\frac{1}{4}$ —do. q. 7th, for 60 feet, 10 in., read 68 feet, 4 in. 1 par.—do. q. 8th, for L. 1 2 6, read L. 1 2 1—Page 40, q. 22d, for 1.685, read 27 feet—Page 52, *Ans.* 8, for 2s. read 3s.—do. 57, q. 2d, f. a+c, read d—Page 59, q. 8th, for b. 490, read l. 400—do. *Ans.* for 56s. $\frac{1}{2}\frac{1}{2}$, read $56\frac{1}{2}\frac{1}{2}$ pence—Page 63, Cafe 2d, q. 2d. *Ans.* read $54 \div 18 = 3$ com diff. + $6 = 2d$ day's journey.—Square Root, Prob. 7, q. 5, for 20.078, read 20.78.

EXERCISES FOR THE WRITING SCHOLAR.

ON IDLENESS.

Action keeps the soul in constant health, but idleness corrupts and rusts the mind; for a man of great abilities may, by negligence and idleness, become so mean and despicable, as to be an incumbrance to society, and a burden to himself. Idleness is a kind of palsy in the mind, so much the more dangerous, as it is scarce ever cured, without producing some disorder. Man was created for action, he must, of necessity, be continually employed; and if it is not in doing good, he is infallibly led to do evil. Idleness has this quality in common with standing waters, that as they ordinarily produce serpents, it commonly begets vices.

ON CALUMNY.

If it come to your knowledge that any man hath spoken evil of you, examine into it without prejudice; and if you find you deserved it, amend your fault, and reckon yourself obliged to those who procured you this advantage. And even though you should be blamed innocently, discover no kind of spite or animosity; for daily experience teaches us that the contempt of calumny makes it die, whereas resentment revives it.

ON SECRECY.

Secrecy is the soul of designs; upon it commonly depends their success; and the more important an undertaking is, the more care ought to be taken not to discover it. Take care, when you form any resolution, however inconsiderable it be, that no body perceive it. Without this precaution, you have reason to fear, it may happen to you, as it frequently does to mines, the whole effect of which terminates in smoke, if they take but the least air.

ON MODESTY.

Modesty is not only an ornament, but also a guard to virtue. It is a kind of quick and delicate feeling in the soul, which makes her shrink and withdraw from every thing that has danger in it. It is such an exquisite sensibility, as warns her to shun the first appearance of every thing which is hurtful.

A person who is too nice an observer of the business of the crowd; like one who is too curious in observing the labour of the bees, will often be stung for his curiosity.

One virtuous disposition of soul is preferable to the greatest natural accomplishments and abilities, and of more value than all the treasures of the world. If you are wise, then study virtue; and condemn every thing that can come in competition with it. Remember, that nothing else deserves one anxious thought or wish. Remember, that this alone is honour, glory, wealth and happiness. Secure this, and you secure every thing; lose this, and all is lost. PRICE.

A man of virtue is an honour to his country, a glory to humanity, a satisfaction to himself, and a benefactor to the whole world. He is rich, without oppression or dishonesty: charitable, without ostentation: courteous, without deceit: and brave, without vice.

Knowledge will not be acquired without pains and application. It is troublesome and deep digging for pure waters; but when once you come to the spring, they rise up, and meet you.

FELTON.

Useful knowledge can have no enemies except the igno-

rant: It cherishes youth, delights the aged, is an ornament in prosperity, and yields comforts in adversity.

No character is more glorious, none more attractive of universal admiration and respect, than that of helping those who are in no condition of helping themselves.

CHARRON.

It was a fine answer of Diogenes, who being asked in mockery, why philosophers were the followers of rich men, and not rich men of philosophers? replied, because the one knew what they had need of, and the other did not.

To know how to forget, is a happiness, rather than an art. Those things are generally best remembered which ought most to be forgot. Sometimes the remedy of an evil consists in forgetting it; and that time it is we commonly forget the remedy.

It was a civil reprehension of a fiddler to king Philip, who disputed with him about his playing: God forbid! said he, that your majesty should be so unhappy as to understand a fiddle better than I do.

They were three good lessons which the bird in the fable gave the fowler for his release: Not to lose a certainty for an uncertainty: Not to give credit to things beyond probability; nor to grieve for that which is past remedy.

Of all the diversions of life, there is none so proper to fill up its empty spaces, as the reading of useful and entertaining authors; and, with that, the conversation of a well-chosen friend.

SPECTATOR.

In human life there is a constant change of fortune; and it is unreasonable to expect an exemption from the common fate: life itself decays, and all things are daily on the change.

PLUTARCH.

A virtuous and well-disposed person, like to good metal, the more he is fired, the more he is fined; the more he is opposed, the more he is approved: Wrongs may well try him, and touch him, but cannot imprint in him any false stamp.

C. RICH.

Diogenes being asked how one should be revenged of his enemy? answered, by being a virtuous and an honest man.

A passionate temper renders a man unfit for advice; deprives him of his reason; robs him of all that's great and noble in his nature; it makes him unfit for conversation; destroys friendship; changes justice into cruelty; and turns all order into confusion.

Zeno said, that an avaricious man was like barren sandy ground, which sucks in all the rain and dews with greediness and thirst; but yields no fruitful herbs or plants to the inhabitants.

To be proud of knowledge is to be blind in the light; to be proud of virtue is to poison yourself with the antidote; and to be proud of authority, is to make your rise your downfall.

Such books as teach wisdom and prudence, and serve to eradicate errors and vices, are the most profitable writings in the world, and ought to be valued and studied more than all others whatsoever.

Fine sense and exalted sense are not half so useful as common sense. There are forty men of wit for one man of sense; and he that will carry nothing about him but gold, will be every day at a loss for want of readier change.

There are few good dispositions of any kind with which the improvement of taste is not more or less connected. A cultivated taste encreases sensibility to all the tender and humane passions, by giving them frequent exercise, while it tends to weaken the more violent and fierce emotions.

BLAIR.

The man, unembarrassed with vulgar cares, who leisurely attends to the flux of things in heaven and earth, and observes the laws by which they are governed, hath secured to himself an easy and convenient seat, where he beholds with pleasure all that passes on the stage of nature; while some of those about him are fast asleep, and others struggling for the highest places, or turning their eyes from the entertainment prepared by Providence to trifling and unworthy pursuits.

TATLER.

Virtue is a quality much more rare than is generally imagined: and therefore the words *Humanity, Virtue, Patriotism*, and many others of similar kinds, should be used with greater caution than they usually are, in the intercourses of mankind.

ZIMMERMAN.

The pleasures of the mind employ us in youth, and amuse us in old age; in prosperity they grace and embellish; in adversity they afford us shelter and support: delightful at home, and easy abroad, they soften slumber, shorten fatigue, and enliven retirement.

CICERO.

True gentleness is founded on a sense of what we owe to him who made us, and to the common nature of which we all share. It arises from reflection on our own failings and wants; and from just views of the condition and the duty of man. It is native feeling heightened and improved by principle. It is the heart which easily relents; which feels for every thing that is human, and is backward and slow to inflict the least wound.

BLAIR.

Sobriety of mind is one of those virtues which the present condition of human life strongly inculcates; the uncertainty of its enjoyments checks presumption; the multiplicity of its dangers demand perpetual caution. Moderation, vigilance, and self-government, are duties incumbent on all; but especially on such as are beginning the journey of life.

BLAIR.

Cause arts and sciences, which distinguish the civilized from the savage man to flourish and abound. Above all, watch carefully over the education of your children. It is from public schools, be assured, that come the wise magistrates, the capable and courageous soldier, the good fathers, the good husbands, the good brothers, the good friends, the good men. —Wherever the youth are seen depraved, the nation is on the decline.

RAYNAL.

To see a father treating his sons like an elder brother, and to see sons covet their father's company and conversation, because they think him the wisest and most agreeable man of their acquaintance, is the most amiable picture the eye can behold, it is a transplanted self-love, as sacred as friendship, as pleasurable as love, and as happy as religion can make it.

If every father remembered his own thoughts and inclinations when he was a son, and every son remembered what he expected from his father, when he himself was in a state of dependency; this one reflection would keep fathers from being rigid, or sons dissolute.

"Pity it is," says the great Mr. Ascham, "that commonly more care is had, yea, and that among very wise men, to find out rather a cunning man for their horse, than a cunning man for their children. They say nay, in word, but they do so in deed: for to one they will gladly give a stipend of two hundred crowns by the year, and loth to offer to the other two hundred shillings! God, that sitteth in heaven, laugheth their choice to scorn, and rewardeth their liberality as it should. For he suffers them to have tame and well-ordered horses, but wild and unfortunate children, and therefore in the end they find more pleasure in their horse, than comfort in their child."

If you be consulted concerning a person either passionate, inconstant, or vicious, give not your advice: It is in vain; for such will do only what shall please themselves.

You are so far from obliging a man by relating to him the ill things that have been said of him, that you are quickly paid for your indiscretion by becoming the first object of his aversion and resentment.

Emulation is a great incitement to industry. Quintilian, among his excellent rules for instructing of youth, speaks to this purpose: Give me a child that is sensible of praise, and touched with glory, and will cry at the shame of being outdone; and I'll keep him to his business by emulation: Reproof will afflict, and honour will encourage him, and I shall not fear to cure him of his idleness.

There is a sort of economy in Providence, that one shall excel, where another is defective, in order to make men more useful to each other, and mix them in society.

SPECTATOR.

There are four good mothers, of whom are often born four unhappy daughters: Truth begets hatred, Prosperity pride, Security danger, and Familiarity contempt.

Some will read over, or rather over read a book, with a view only to find fault: Like venomous spiders, extracting a poisonous quality, where the industrious bees sip out a sweet and profitable juice.

For a man to see and acknowledge his own ignorance and defects; to pretend to no more than he really hath and is; this single quality argues so much judgment, that there are few better testimonies to be given of it.

CHARRON.

Epaminondas, Prince of Thebes, had such hatred to idleness, that, finding one of his captains asleep in the day-time, he slew him; for which act, being reproved by his nobles, he replied, I left him as I found him; comparing idle men to dead men.

It was a good reproof of Aristotle's to an egregious prater, that had perplexed him with many absurd stories, and concluded every one with this idle repetition, and is this a wonderful thing? No wonder at all, said Aristotle, this; but if a man should stand still to hear you prate thus, that were a wonder indeed!

It was a pretty victory which Euclid got of his angry brother, who, being highly displeased, cried out, Let me perish, if I be not revenged! But he answered, And let me perish, if I do not make you kind, and quickly to forget your anger.

'Tis great imprudence to determine children to any particular business before their temper and inclinations are well known. Every one, says Horace, is best in his own profession: that which fits us best, is best; nor is any thing more fitting then, than that every one should consider his own genius and capacity, and act accordingly.

When you look forward to those plans of life, which either your circumstances have suggested, or your friends have proposed, you will not hesitate to acknowledge, that, in order to pursue them with advantage, some previous discipline is requisite. Be assured, that whatever is to be your profession, no education is more necessary to your success, than the acquirement of virtuous dispositions and habits. This is the universal preparation for every character, and every station in life.

BLAIR.

The most proper objects of your bounty are the necessitous. Give the same sum of money which you bestow on a person in tolerable circumstances, to one in extreme poverty; and observe what a wide disproportion of happiness is produced. In the latter case, it is like giving a cordial to a fainting person; in the former, it is like giving urine to him who has al-

ready quenched his thirst. Mercy is seasonable in time of affliction, like clouds of rain in the time of drought.

True honour, though it be a different principle from religion, is that which produces the same effects. The lines of action, though drawn from different parts, terminate in the same point. Religion embraces virtue as it is enjoined by the laws of God; honour, as it is graceful and ornamental to human nature. The religious man fears, the man of honour scorns, to do an ill action. The latter considers vice as something that is beneath him; the other, as something that is offensive to the Divine Being: the one, as what is unbecoming; the other, as what is forbidden.

GUARDIAN.

Those who have mistaken notions of honour, are such as establish any thing to themselves for a point of honour, which is contrary either to the laws of God, or of their country; who think it more honourable to revenge, than to forgive an injury; who make no scruple of telling a lie, but would put any man to death that accuses them of it; who are more careful to guard their reputation by their courage than by their virtue. True fortitude is indeed so becoming in human nature, that he who wants it scarce deserves the name of a man; but we find several who so much abuse this notion, that they place the whole idea of honour in a kind of brutal courage; by which means we have had many among us, who have called themselves men of honour, that would have been a disgrace to a gibbet.

GUARDIAN.

ON BENEVOLENCE AND CHARITY.

Form as amiable sentiments as you can, of nations, communities of men, and individuals. If they are true, you do them only justice; if false, though your opinion does not alter their nature and make them lovely, you yourself are more lovely for entertaining such sentiments. When you feel the bright warmth of a temper thoroughly good in your own breast, you will see something good in every one about you. It is a mark of littleness of spirit to confine yourself to some minute part of a man's character: a man of generous, open, extended views, will grasp the whole of it; without which he cannot pass a right judgment on any part.

That works of ingenuity and elegance are particularly becoming in our sex, and that the study of them ought to enter into female education as much as possible, all, I think, are agreed.

FORDYCE.

We can prognosticate nothing virtuous, nothing happy, concerning those wretched creatures of either sex, that do not feel for the satisfaction, ease, or honour of their parents.

FORDYCE.

Seneca exhorts young men to preserve always a great respect for their masters, to whose care they are indebted for the amendment of their faults, and for having imbibed sentiments of honour and probity.

So violent are the passions of anger and revenge in the human breast, that it is not wonderful that men should persecute their real or imaginary enemies with cruelty and malevolence; but that there should exist in nature a being who can receive pleasure from giving pain, would be totally incredible, if we were not convinced, by melancholy experience, that there are not only many, but that this unaccountable disposition is in some manner inherent in the nature of man; for as he cannot be taught by example, nor led to it by temptation, or prompted to it by interest, it must be derived from his native constitution: and is a remarkable confirmation of what revelation so frequently inculcates—that he brings into the world with him an original depravity, the effects of a fallen and degenerate state; in proof of which we need only observe, that the nearer he approaches to a state of nature, the more predominant this disposition appears, and the more violent it operates.

Love is the life and soul of every relative duty, the powerful, enlivening principle, which alone can inspire us with vigour and activity in the execution of it. Without this, even diligence is ungrateful, and submission itself has the air of disobedience.

Friendship is a disinterested affection, founded only on esteem, and of all the passions most nearly resembles love; nor is there the least difference, if we suppose this last independent of the sex of the person beloved. If Platonic love is not a mere chimera, it is nothing else but friendship, which is neither increased nor diminished by the difference of sex of the two friends.

Cato and Tully boast of this as the great comfort and joy of their old age, that nothing was more pleasant to them, than the consciousness of a well spent life, and the remembrance of many benefits and kindnesses done to others.

There is no vice or failing of man that doth unprincipled humanity, like ingratitude; since he who is guilty of it lives unworthy of his soul, that hath not virtue enough to be obliged, or acknowledge the due merits of the obliger.

Great qualities make great men. Who, says Seneca, is a gentleman? The man whom nature hath disposed, and as it were cut out for virtue: this man is well born indeed; for he wants nothing else to make him noble, who has a mind so generous, that he can rise above, and triumph over fortune, let his condition of life be what it will.

The Redbreast, sacred to the household gods,
Wisely regardful of th' embroiling sky,
In joyless fields and thorny thickets, leaves
His thiv'ring mates; and pays to trusted man
His annual visit. Half afraid, he first
Against the window beats; then, brisk alights
On the warm hearth; then, hopping o'er the floor,
Eyes all the smiling family askance,
And pecks, and starts, and wonders where he is:
Till, more familiar grown, the table crumbs
Attract his slender feet.

THOMSON.

There is a time
For those whom wisdom and whom nature charm,
To steal themselves from the degenerate croud,
And soar above this little scene of things;
To tread low-thoughted vice beneath their feet;
To soothe the throbbing passions into peace,
And woo lone quiet in her silent walks.

THOMSON.

'Twas thus, by the glare of false science betray'd,
That leads, to bewilder; and dazzles, to blind;
My thoughts wont to roam, from shade onward to shade,
Destruction before me, and sorrow behind.
O, pity, great Father of light, then I cry'd,
Thy creature who fain would not wander from thee!
Lo, humbled in dust, I relinquish my pride:
From doubt and from darkness thou only canst free.

BEATTIE.

True happiness is not confin'd,
To wealth and honours, pomp and show;
It dwells with the contented mind,
Or we'll not find it here below.
And ah! too sure, here, 'tis not found,
For ev'n the shepherd has his care;
Pangs ev'ry human bosom wound:—
Look up to Heav'n—'tis real there.

Cheerfulness!

Fair guardian of domestic life,
Kind banisher of home-bred strife,

Nor fullen lip, nor taunting eye
Deforms the scene when thou art by.
No sickening husband damns the hour
Which bound his joys to female power;
No pining mother weeps the cares
Which parents waste on thankless heirs;
Th' officious daughters, pleas'd, attend;
The brother adds the name of friend;
By thee, with flowers, their board is crown'd,
With songs from thee their walks resound;
And morn with welcome lustre shines,
And evening unperceiv'd declines.

Friendship! mysterious cement of the soul;
Sweet'ner of life, and folder of society;
I owe thee much. Thou hast deserv'd from me,
Far, far beyond what I can ever pay.
Oft have I prov'd the labours of thy love,
And the warm efforts of the gentle heart,
Anxious to please.—Oh! when my friend and I,
In some thick wood have wander'd heedless on,
Hid from the vulgar eye; and sat us down
Upon the sloping cowslip-cover'd bank,
Where the pure limpid stream has slid along,
In grateful errors through the underwood,
Sweet murmuring: methought, the shrill-tongu'd thrush
Mended his song of love: the sooty black bird
Mellow'd his pipe, and soften'd every note:
The eglantine smell'd sweeter, and the rose
Assum'd a dye more deep; whilst ev'ry flower
Vy'd with it's fellow-plant in luxury
Of dress.—Oh! then, the longest summer's day
Seem'd too, too much in haste: still, the full heart
Had not imparted half. 'Twas happiness
Too exquisite to last. Of joys departed,
Not to return, how painful the remembrance.

BLAIR.

BEAUTY.

May my song soften, as thy daughters, I,
Britannia, hail! for beauty is their own;
The feeling heart, simplicity of life,
And elegance, and taste; the faultless form,
Shap'd by the hand of harmony; the cheek
Where the live crimson, thro' the native white
Soft shooting, o'er the face, diffuses bloom,
And ev'ry nameless grace; the parted lip,
Like the red rose-bud moist with morning-dew,
Breathing delight! and, under flowing jet,
Or sunny ringlets, or of circling brown,
The neck slight-shaded, and the swelling breast;
The look resistless, piercing to the soul,
And by the soul inform'd, when, dress'd in love,
She sits, high-smiling in the conscious eye.

THOMSON.

NEGLECTED MERIT.

Full many a gem of purest ray serene,
The dark unfathom'd caves of ocean bear:
Full many a flow'r is born to blush unseen,
And waste it's sweetness on the desert air.

GRAY.

Immodest words admit of no defence,
For want of decency is want of sense.
In modest actions there are certain rules,
Which, to transgress, confirms us knaves or fools.

Credit obtain'd, untruth for truth may pass
As current coin, tho' underneath 'tis brass:
But if perfidious thou but once is found,
Thy words, tho' true, like to untruth will sound.

Remember what our father oft has told us,
The ways of Heaven are dark and intricate,
Puzzl'd with mazes, and perplex'd with errors.

And is this all, can reason do no more
Than bid me shun the deep, and dread the shore.
Sweet moralist, afloat on life's rough sea,
The Christian has a heart unknown to thee;
He holds no parley with unmanly fears,
Where duty bids he confidently steers;
Faces a thousand dangers at her call,
And trusting in his God, surmounts them all.

COWPER.

RURAL HAPPINESS.

In rural innocence secure I dwell,
Alike to fortune and to fame unknown;
Approving conscience cheers my humble cell,
And social quiet marks me for her own.
Next to the blessings of religious truth,
Two gifts my endless gratitude engage;
A wife, the joy and transport of my youth,
Now with a son the comfort of my age.
Seek not to draw me from this kind retreat;
In loftier spheres unfit, untaught to move;
Content with calm domestic life were meet,
The sweets of friendship, and the smiles of love.

TO A YOUNG GIRL OF FIVE YEARS OLD.

Fairest flower, all flow'rs excelling
Which in Eden's garden grew,
Flow'rs of Eve's embower'd dwelling
Are, my fair one, types of you.
Mark, my Polly, how the roses
Emulate thy damask cheek;
How the bud it's sweets discloses,
Buds thy opening bloom bespeak.
Lillies are, by plain direction,
Emblems of thy fair complexion,
Emblems of thy fairer mind:
But, dear girl, both flow'rs and beauty
Blossom, fade, and fade and die away;
Then pursue good sense and duty,
Evergreens that ne'er decay.

VOWELS.

We are little airy creatures,
All of diff'rent voice and features;
One of us in glass is set,
One of us you'll find in jet;
T'other you may see in tin,
And the fourth a box within;
If the fifth you should pursue
It can never fly from you.

TIME.

Ever eating, never cloying,
All devouring, all destroying,
Never finding full repast,
Till I eat the world at last.

RURAL LIFE.

The rage of nations, and the crush of states,
Move not the man, who from the world escap'd,
In still retreats and flow'ry solitudes
To nature's voice attends, from month to month,
And day to day, thro' the revolving year;
Admiring, sees her in her every shape;
Feels all her sweet emotions at his heart;
Takes what she liberal gives, nor thinks of more.

THOMSON.

HECTOR AND ANDROMACHE.

And. "Too daring prince!—Ah! whither dost thou run
"Ah! too forgetful of thy wife and son!
"And, think'st thou not, how wretched we shall be?
"A widow I, an helpless orphan he!
"For sure, such courage, length of life denies;
"And thou must fall thy virtue's sacrifice."

Her. "Andromache! my soul's far better part!
"Why, with untimely sorrows, heaves thy heart?
"No hostile hand can antedate my doom,
"Till fate condemn me to the silent tomb."

And. "Greece, in her single heroes strove in vain:
"Now hosts oppose thee—and thou must be slain:
"Oh, grant me, gods! ere Hector meets his doom,
"All I can ask of Heav'n—an early tomb!"

CHARACTER OF MAN.

Know thou thyself; presume not God to scan:
The proper study of mankind, is man.
Plac'd on this isthmus of a middle state,
A being darkly wise, and rudely great:
With too much knowledge for the sceptic side,
With too much weakness for the stoic's pride,
He hangs between; in doubt to act, or rest;
In doubt to deem himself a god, or beast;
In doubt his mind or body to prefer;
Born, but to die; and reas'ning, but to err.
Chaos of thought and passion, all confus'd,
Still by himself abus'd, or disabus'd;
Created, half to rise, and half to fall;
Great Lord of all things, yet a prey to all;
Sole judge of truth, in endless error hurl'd;
The glory, jest, and riddle of the world.

POPE.

ADDRESS TO A NIGHTINGALE.

O nightingale! best poet of the grove,
That plaintive strain can ne'er belong to thee,
Blest in the full possession of thy love:
O lend that strain, sweet Nightingale! to me,
'Tis mine, alas! to mourn my wretched fate:
I love a maid who all my bosom charms,
Yet lose my days without this lovely mate;
Inhuman fortune keeps her from my arms.
You, happy birds! by nature's simple laws
Lead your soft lives, sustain'd by nature's fare;
You dwell wherever roving fancy draws,
And love and song is all your pleasing care.
But we, vain slaves of int'rest and of pride,
Dare not be blest, lest envious tongues should blame;
And hence in vain I languish for my bride,
O mourn with me, sweet bird! my hapless flame.

THOMSON.

SONG.

Come, dear Amanda, quit the town;
And to the rural hamlets fly;
Behold, the wintery storms are gone,
A gentle radiance glads the sky.
The birds awake, the flow'rs appear,
Earth spreads a verdant couch for thee;
'Tis joy and music all we hear!
'Tis love and beauty all we see!
Come, let us mark the gradual spring,
How peep the buds, the blossom blows,
Till Philomel begins to sing,
And perfect May to spread the rose.
Let us secure the short delight,
And wisely crop the blooming day;
For soon, too soon, it will be night:
Arise, my love, and come away.

SOLICITUDE.

Why wilt thou my passion reprove?
Why term it a folly to grieve?
Ere I show you the charms of my love,
She is fairer than you can believe.
With her mien she enamours the brave;
With her wit she engages the free;
With her modesty pleases the grave;
She is ev'ry way pleasing to me.

SHENSTONE.

Honour's a sacred tie, the law of kings,
The noble mind's distinguishing perfection,
That aids and strengthens virtue when it meets her,
And imitates her actions where she is not;
It ought not to be sported with.

CATO.

In human works, tho' labour'd on with pain,
A thousand movements scarce one purpose gain;
In God's, one single can it's end produce,
Yet serves as second, to some other use.
So man, who here seems principal alone,
Perhaps acts second to some sphere unknown,
'Tis but a part we see, and not a whole.

POPE.

Who is Silvia? what is she,
That all our swains commend her?
Holy, fair, and wise is she;
The heavens such grace did lend her,
That she might admired be.
Is she kind as she is fair?
For beauty lives with kindness:
Love doth to her eyes repair,
To help him of his blindness;
And, being help'd, inhabits there.
Then to Silvia let us sing,
That Silvia is excelling;
She excels each mortal thing
Upon the dull earth dwelling;
To her let us garlands bring.

SHAKESPEAR.

BEAUTY.

Beauty is but a vain, a fleeting good,
A shining gloss that fadeth suddenly;
A flow'r that dies when almost in the bud,
A brittle glass that breaketh presently.
A fleeting good, a gloss, a glass, a flow'r,
Lost, faded, broken, dead, within an hour.
As goods, when lost, we know are seldom found,
As fading gloss, no rubbing can excite,
As flow'rs, when dead, are trampled on the ground,
As broken glass no cement can unite:
So beauty blemish'd once, is ever lost,
In spite of physic, painting, pains and cost.

SHAKESPEAR.

You gave me last week a young linnet,
Shut up in a fine golden cage;
Yet how sad the poor thing was within it,
O how it did flutter and rage!
Then he mop'd and he pin'd
That his wings were confin'd,
Till I open'd the door of his den:
Then so merry was he;
And, because he was free,
He came to his cage back again.

GARRICK.

AN ITALIAN SONG.—ROGERS.

Dear, in my little native vale
The ring-dove builds and warbles there;
Close by my cot she tells her tale
To every passing villager.

The squirrel leaps from tree to tree,
And shells his nuts at liberty.

In orange groves and myrtle bowers
That breathe a gale of fragrance round,
I charm the fairy-footed hours
With my lov'd lute's romantic sound;
Or crowns of living laurel weave,
For those that win the race at eve.

The shepherd's horn at break of day,
The ballet danc'd in twilight glade,
The canzonet and roundelay
Sung in the silent greenwood shade;
These simple joys that ne'er can fail,
Shall bid me to my native vale.

ON PROVIDENCE.

There is a pow'r
Unseen, that rules th' illimitable world,
That guides it's motions, from the brightest star
To the least dust of this sin-tainted mould;
While man, who madly deems himself the lord
Of all, is nought but weakness and dependence.
This sacred truth, by sure experience taught,
Thou must have learnt when wandering all alone,
Each bird, each insect, flitting thro' the sky,
Was more sufficient for itself than thou.

THOMSON.

FINE ARTS.

Distinguish'd far her * lofty temple stands,
Where the tall mountain looks o'er distant lands;
All round her throne the graceful arts appear,
That boast the empire of the eye or ear.
See favour'd first, and nearest to the throne
By the rapt mien of musing Silence known,
Fled from herself, the Pow'r of Numbers plac'd,
Her wild thoughts watch'd by Harmony and Taste.

There (but at distance never meant to vie),
The full-form'd image glancing on her eye,
See lively Painting! on her various face,
Quick-gliding forms a moment find a place;
She looks, she acts the character she gives,
And a new feature in each feature lives.

See Attic ease in Sculpture's graceful air,
Half loose her robe, and half unbound her hair;
To life, to life, she smiling seems to call,
And down her fair hands negligently fall.

Last, but not meanest, of the glorious choir,
See Music, list'ning to an angel's lyre.

Simplicity, their beauteous handmaid, drest
By Nature, bears a field-flower on her breast.

O Arts divine! O magic Powers that move
The springs of truth, enlarging truth and love!
Lost in their charms each mean attachment ends,
And Taste and Knowledge thus are Virtue's friends.

Thus nature deigns to sympathize with art,
And leads the moral beauty to the heart;
There, only there, that strong attraction lies,
Which wakes the soul, and bids her graces rise,
Lives in those powers of harmony that bind
Congenial hearts, and stretch from mind to mind.

* Reason.

